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STEAM BOILERS

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Feed-Water Heaters,

Injectors, Ejectors,

McCLAVE PATENT Grate Bars,

And "Argand" Steam Blowers.

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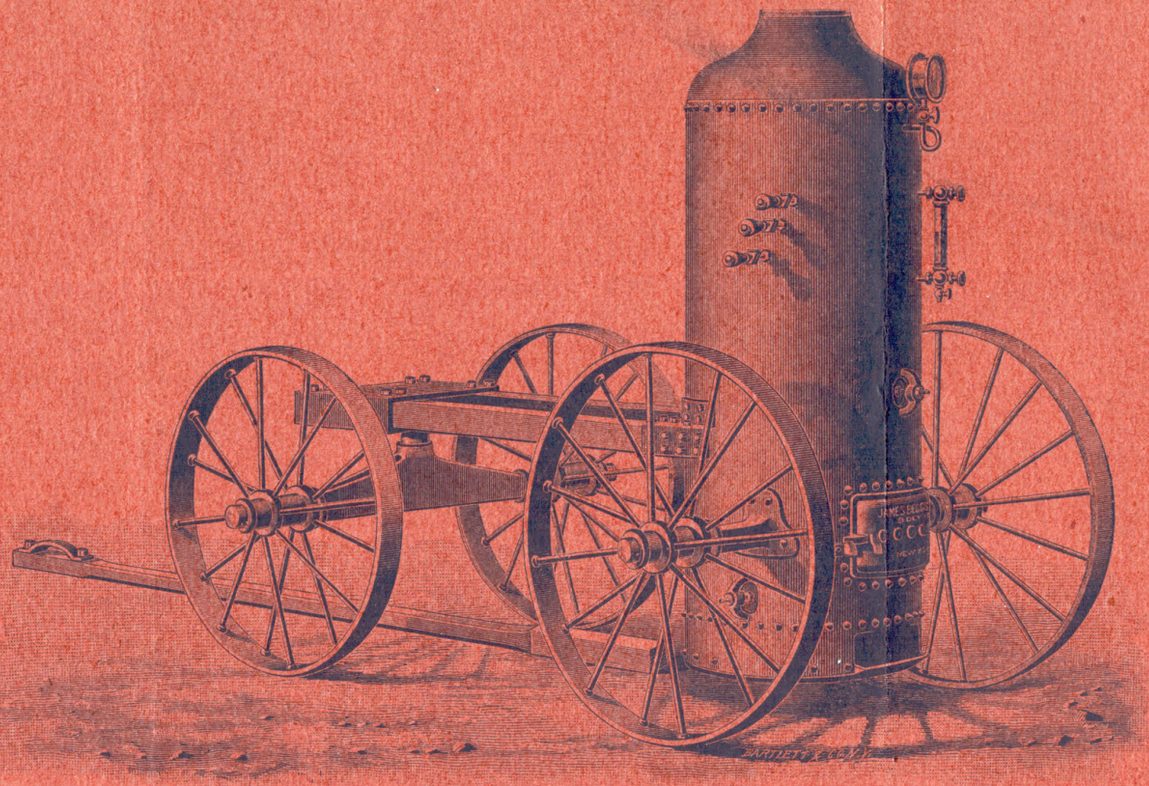

VERTICAL BOILER, MOUNTED ON WHEELS.

For Specifications, see page 26.

MANUFACTURERS OF

Improved Steam Engines, Marine and Stationary Boilers, Foundry Cupolas, Tanks, Coal Buckets, Smokestacks,

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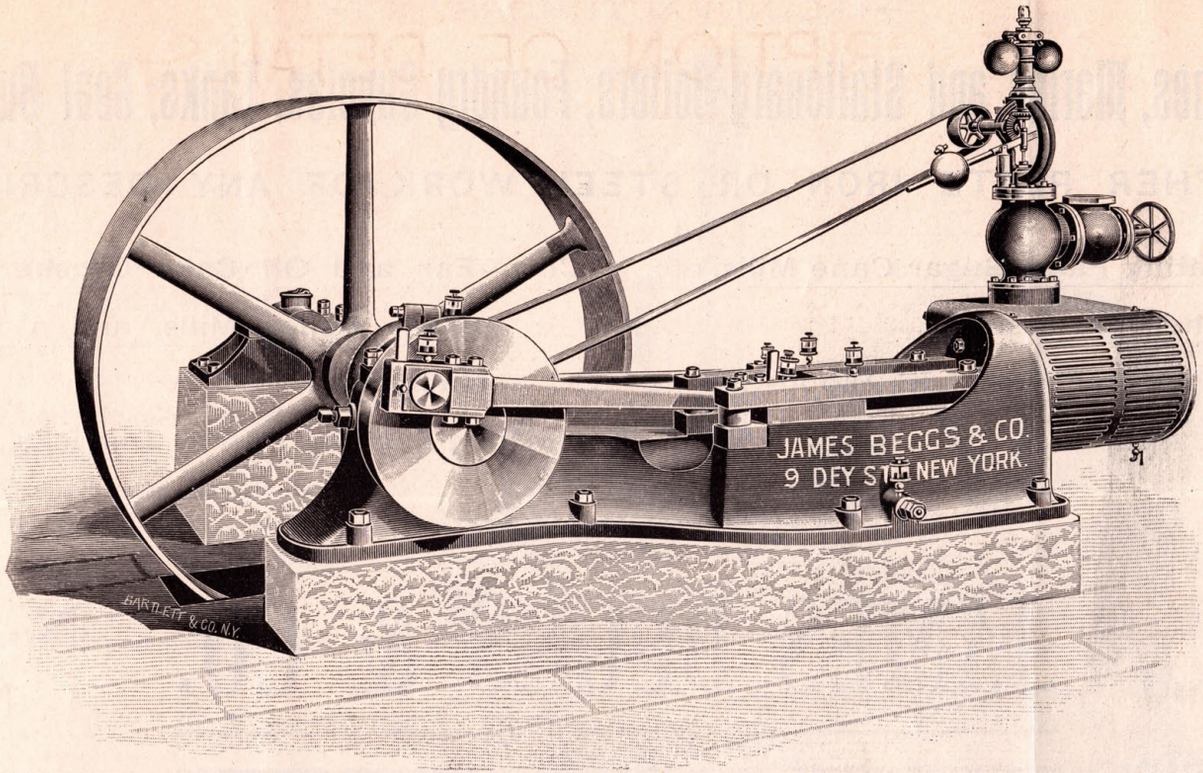
SPECIAL ATTENTION GIVEN TO THE DETAILS OF SHIPMENTS FOR EXPORT.

In ordering, state whether right or left hand Engine is wanted. The engraving shows a right-hand Engine.

If not otherwise mentioned in order, we will understand that either hand will answer.



Every Engine is run with Steam at our works, and thoroughly tested under a full load. After a satisfactory test the packing is removed from the stuffing-boxes, the Engine taken apart, wiped, and thoroughly oiled, to insure reliable working condition upon arrival at its destination.

SPECIFICATIONS OF HORIZONTAL STATIONARY STEAM ENGINES, WITH OUR DESIGN OF IMPROVED BALANCED SLIDE-VALVES; AND PILLOW-BLOCKS, FITTED WITH PATENT EQUALIZING QUARTER-BOXES.

Number of Size	1 E	1 D	1 C	1 B	1 A	1	2	3 A	3	4 A	4	5 A	5	6 A	6	7 A	7	8 A	8	9	10
Horse-Power, as usually rated	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**	**70**	**80**	**90**	**100**	**125**	**150**	**175**	**200**	**250**	**300**
Usual Number of Revolutions per minute	45	50	90	115	130	150	150	135	150	140	150	135	150	135	150	115	135	115	130	120	110
Diameter of Cylinder by Length of Stroke	**10x15**	**10x15**	**10x15**	**10x15**	**10x15**	**10x15**	**11x15**	**12x16**	**12x16**	**13x16**	**13x16**	**14x18**	**14x18**	**16x18**	**16x18**	**18x22**	**18x22**	**20x24**	**20x24**	**22x28**	**24x30**
Diameter of Steam-Pipe and Governor (In inches.)	2½	2½	2½	2½	2½	2½	3	3½	3½	3½	3½	4	4	5	5	6	6	6	6	7	8
Diameter of Exhaust-Pipe	3½	3½	3½	3½	3½	3½	4	4½	4½	4½	4½	5	5	6	6	7	7	7	7	8	9
Diameter of Band-Wheel	60	60	66	72	72	72	72	78	78	78	78	84	84	84	84	96	96	108	108	120	120
Face of Band-Wheel	8	9	10	10	12	12½	15	15	15	17	17	17	17	19	19	24	24	29	29	32	40
Diameter of Crank-Shaft	4⅝	4⅝	4⅝	4⅝	4⅝	4⅝	4⅞	5⅛	5⅛	5⅜	5⅜	6	6	6½	6½	8½	8½	10	10	11	12
Diameter of Crank-Pin	2½	2½	2½	2½	2½	2½	2¾	3	3	3¼	3¼	3½	3½	4	4	4½	4½	5	5	5½	6
Length of Shaft from center of Engine...in feet	6	6	6	6	6	6	6	7	7	7	7	7½	7½	8	8	8½	8½	9½	9½	10	11¼
Length of Engine Bed, about..... "	7¼	7¼	7¼	7¼	7¼	7¼	7½	8	8	8	8	8¾	8¾	9	9	10½	10½	12	12	13½	14¾
Width of Engine Bed.....in inches	29¾	29¾	29¾	29¾	29¾	29¾	29¾	35½	35½	35½	35½	38	38	40½	40½	55	55	56	56	58	61
Diameter by Length of Main Shaft Bearings. "	4⅝x11	4⅝x11	4⅝x11	4⅝x11	4⅝x11	4⅝x11	4¾x11	5½x13	5½x13	5⅝x13	5⅝x13	6x14	6x14	6½x15½	6½x15½	8¼x18	8½x18	10x20	10x20	11x22	12x24
Shipping Weight, in pounds .....about	3,600	3,600	3,700	3,800	3,800	3,800	4,200	5,800	5,800	6,000	6,000	7,700	7,700	10,500	10,500	17,350	17,350	26,700	26,700	30,800	37,000
Engine, with Regular Fixtures	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$

The Regular Fixtures comprise: Continuous Sight-Feed Cylinder Lubricator; Oil Cups; Drips from Cylinder; Improved Governor, with Patent Automatic Safety-Stop Attachment (which effectually prevents the running away of engine) and Adjustable Speeder. This Governor is sensitive and accurate, enabling a close adjustment and superior regulation of speed under varying conditions of loads and steam pressure; Throttle-Valve; and Band-Wheel, turned and balanced, per specifications.

FLY-WHEELS AND SMALL BAND-WHEELS SUBSTITUTED FOR THE REGULAR BAND-WHEELS, WHEN SO ORDERED, AT THE ADDITIONAL PRICE.

Diameter of Fly-Wheel.....in inches	72	72	72	72	84	84	84	86	86	86	86	96	96	96	96	108	108	120	120	120	120
Diameter of Band-Wheel..... "	44	44	44	42	42	42	42	48	48	48	48	60	60	60	60	60	60	72	72	78	84
Face of Band-Wheel ..... "	10½	12½	12½	12½	12½	12½	15	15	15	15	15	17	17	19	19	21	21	24	24	26	32
Price, additional	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$

The stated capacities of the Engines given in the List can be exceeded in cases of emergency.

DESCRIPTION OF DETAILS.

OUR engines are heavy and substantial, simple in design and effective, being intended for hard and enduring service; they are made with great care and from patterns of our latest design, combining all our most recent improvements suggested by many years of experience in engine building, are plainly but strongly constructed; require the least possible attention and repairs, and, by reason of their superior workmanship and simplicity, can be placed in charge of persons having little experience in the care of steam engines. Consequently skilled and experienced attendance is not required. Many of the engines on the market have more bright work than ours, and are, to some, more pleasing to the eye, but when the proportions of the different parts are compared it will be found, in most instances, that they are much weaker in build, and that they cannot stand as hard work and will not last as long as ours. We have shipped our engines to almost every part of the world, and more than 10,000 of them are in use.

We guarantee these engines to have ample cylinder capacity to develop the full indicated Horse-power stated, when speeded to run at about the given number of revolutions per minute. All parts are properly proportioned throughout, in accordance with the cylinder power as specified.

The Working Parts are of unusually large dimensions, and constructed in the simplest manner, being provided with suitable means for adjustment and compensation, so that should it become necessary, through an extension of business, to realize a corresponding increase of power, the number of revolutions may be increased within reasonable limits, depending, of course, upon the working conditions, and a proportionate increase of power secured thereby. *This is done*, and with the full assurance that these engines will continue to perform their work in an entirely satisfactory manner. A number of these engines are running, to the satisfaction of the customers, at speeds of 50 per cent. and upwards above their rated capacity; but we do not recommend such an extreme practice, as it is both unwise and extravagant.

The Crank-Shaft is made of well Hammered Wrought Iron of best quality.

The Crank-Pin is made of well Hammered Steel of best quality.

The Main Shaft Bearing and Outboard Pillow Block are lined with genuine Anti-attrition Metal.

The Connecting-Rod is extra strong, of best Wrought Iron, well Hammered. The ends are fitted—locomotive practice—with straps secured by bolts and key with set-screw, and have composition boxes. In the cross-head end of our connecting-rod we have a box with square end, instead of the usual round shape, leaving a large fillet in the corners for strength. We do this because the old style of round box continually works loose, and is, therefore, a perpetual source of annoyance. All the disadvantages of the round box are, in our form, successfully overcome.

The Cross-Head Pin is extra large, to prevent excessive friction and insure greater durability. In many other styles of engines these pins are very much smaller than they ought to be, and with a full load are very troublesome from consequent heating and cutting; therefore they have to be very soon replaced.

The Cross-Head and Slides are of the well-known locomotive type; the slides are of extra length, and, therefore, the cross-head has nearly one-half more wearing surface than is usually given to engines of this class; all wearing surfaces of cross-head are faced with genuine Anti-attrition Metal.

Our form of Eccentric and Strap was introduced upon locomotives many years ago, and has proved itself the most durable of any form yet introduced. It combines all the advantages of a spherical surface without the extra expense attendant upon its manufacture. The strap is formed to hold a quantity of oil, which is essentially necessary in case the oil cup stops feeding, so that the danger of cutting the surfaces of eccentric and strap from this cause is next to nothing. It will not wobble or vibrate, as a spherical strap sometimes does.

The Ports, of which there are **four,** are nearly equal in length to the diameter of the cylinder, and located as near its ends as possible, in order to reduce the clearance and thereby economize the use of steam. These ports are proportionately large, and so located as to insure perfect drainage, which, combined with a short travel of valve, prevents unnecessary friction, and admits of a higher rate of speed than with ordinary types of engines.

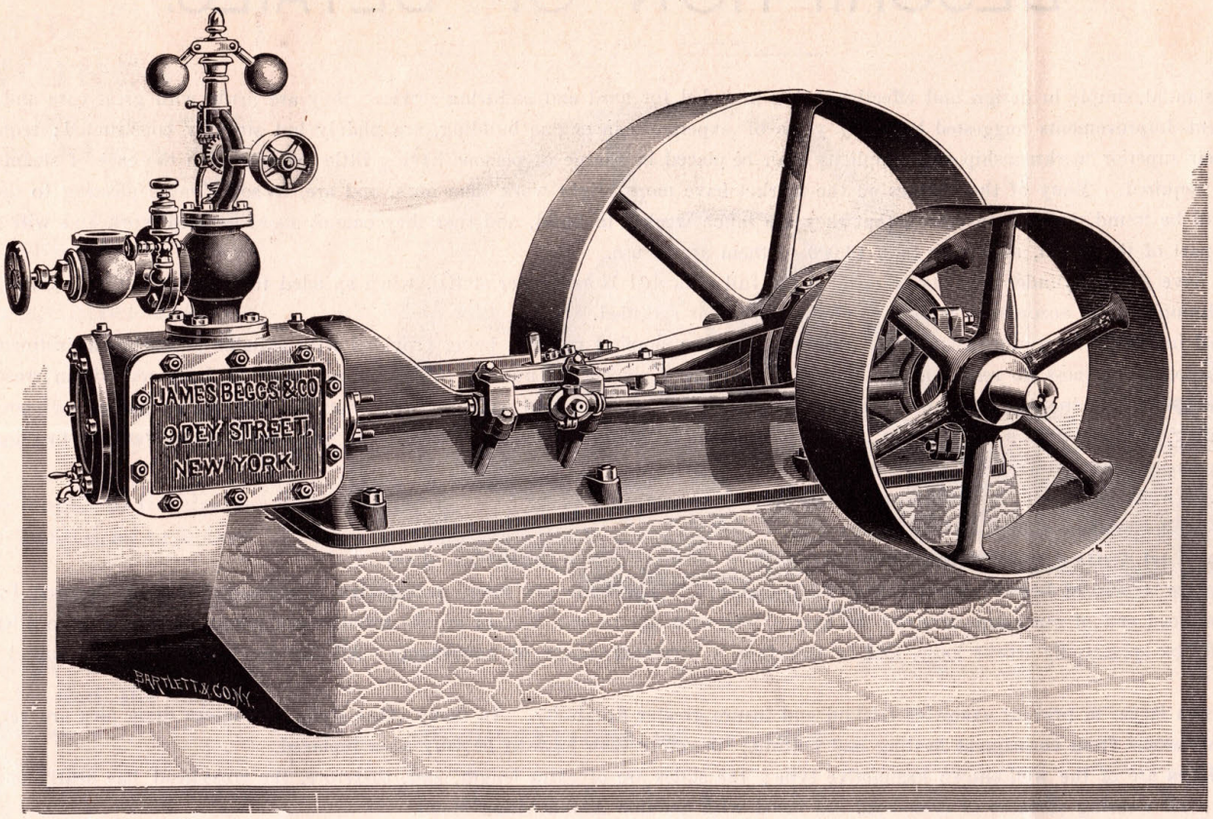
The Valve is double and covers the ports at each end of steam chest. The back of this valve is covered by a steam-tight packing, leaving only a sufficient surface exposed to insure the valve being kept in contact with the valve seat under all conditions of load; this means a reduction of friction and an increase of about 80 per cent. in the durability of the eccentric-strap, rod-pin and all parts of the valve motion. The valve and valve seat being relieved of the greater portion of their load, very little lubrication is required, which is a very essential consideration where the exhaust steam is used for chemical purposes, or where any considerable quantity of oil would be a serious detriment to the process.

The Piston is in one piece, being a casting cored out, for lightness, and being pressed on to the piston rod is securely held.

The Piston Packing Rings are of an improved type, combining the most desirable results of recent locomotive practice and are sprung into grooves turned in the piston, with the openings held about two inches from each other on the underside, to avoid the possibility of leakage. These packing rings are plain, simple, and easily renewed at a trifling expense. This style of packing has been extensively adopted on Railroads, as it works with less friction than other forms of packing; it is more durable and much to be preferred to the "spring" and "steam" packings so generally used by engine builders, as we use no springs and do not admit steam behind these rings. The objection to all forms of "steam" packing (principally those above alluded to) is that they wear the cylinder out of true, causing it to resemble the mouth of a bell at each end.

No effort is spared to make these the best Slide-valve Engines in the market; and the parts are made accurately to gauge on the interchangeable part system, so as to facilitate renewals in case of wear.

Every Engine is run with Steam at our Works, and thoroughly tested under a full load. After a satisfactory test the packing is removed from the stuffing-boxes, the Engine taken apart and wiped and thoroughly oiled, to insure reliable working conditions upon arrival at its destination.



SPECIFICATIONS OF HORIZONTAL, SELF-CONTAINED ("CENTER-CRANK") STEAM ENGINES, WITH OUR DESIGN OF IMPROVED BALANCED SLIDE-VALVES; AND PILLOW-BLOCKS, FITTED WITH PATENT EQUALIZING QUARTER-BOXES.

Number of Size	**1**	**2**	**3**	**4**	**5**	**6**	**7 A**	**7**	**8**	**9 A**	**9**	**10 A**	**10**	**11 A**	**11**	**12 B**	**12 A**	**12**
Horse-Power, as usually rated	**8**	**10**	**12**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**	**65**	**70**	**80**	**90**	**100**
Usual number of revolutions per minute	200	175	175	150	150	150	130	150	150	135	150	140	150	140	150	120	135	150
Diam. Cylinder by Length of Stroke.	**6x9**	**7x10**	**8x10**	**8x12**	**9x12**	**10x12**	**10x15**	**10x15**	**11x15**	**12x16**	**12x16**	**13x16**	**13x16**	**14x16**	**14x16**	**16x18**	**16x18**	**16x18**
Diameter of Crank-Shaft (In inches.)	2⅜	2⅝	2⅞	3	3⅜	3⅝	3⅞	3⅞	4⅜	4⅞	4⅞	4⅞	4⅞	5⅜	5⅜	5⅞	5⅞	5⅞
Diameter of Crank-Pin	2¼	2½	2⅝	2¾	3⅛	3½	3¾	3¾	4¼	4¾	4¾	4¾	4¾	5⅛	5⅛	5⅝	5⅝	5⅝
Diam. by Length of Crank-Shaft Bearings	2⅜x5½	2⅝x6	2⅞x6	3x7	3⅜x7½	3⅝x8½	3⅞x8½	3⅞x8½	4⅜x9	4⅞x10	4⅞x10	4⅞x10	4⅞x10	5⅜x12	5⅜x12	5⅞x14	5⅞x14	5⅞x14
Diameter of Steam-Pipe	1¼	1½	2	2	2½	2½	2½	2½	3	3½	3½	3½	3½	4	4	5	5	5
Diameter of Exhaust-Pipe	2	2	2½	2½	3	3	3½	3½	4	4½	4½	4½	4½	5	5	6	6	6
Whole Length of Crank-Shaft	49	53	54	58	58	66	74	74	75	77	77	77	77	78⅛	78⅛	88	88	88
Size of Large Band-Wheel, diam. by face.	36x9½	44x10½	44x12½	48x12½	54x12½	54x12½	60x14½	60x14½	60x14½	72x14½	72x14½	72x16½	72x16½	72x16½	72x16½	78x16½	78x16½	78x16½
Size of Small Band-Wheel, diam. by face.	16x10½	20x10½	20x10½	32x10½	32x10½	32x10½	36x10½	36x10½	36x12½	36x12½	36x12½	36x12½	36x12½	36x12½	36x12½	48x12½	48x12½	48x12½
Shipping Weight, in pounds.....about	1,400	1,700	2,100	2,400	3,100	3,400	4,200	4,200	4,700	6,000	6,000	6,500	6,500	7,600	7,600	10,900	10,900	10,900
Engine, with Regular Fixtures	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$

The Regular Fixtures comprise: Lubricator; Oil Cups; Drips from Cylinder; Improved Governor, with Throttle-Valve; and Band-Wheels, turned and balanced, per Specifications.

The stated capacities of the Engines given in the List can be exceeded in cases of emergency.

DESCRIPTION OF DETAILS.

THE Crank-Shaft is cut from the solid forging and has no welds to weaken the shaft or to separate. Each side of crank is provided with our improved full disk, very securely attached, and contains a counterweight, thereby accurately balancing the reciprocating parts, so that the engine runs easily and steadily with the least possible friction. A good-sized fillet is formed upon the shaft at each side of the crank, also at each end of the crank-pin; there are no square corners or shoulders, where the vibrations can concentrate, which, in time, always cause a crystallization of the material, and a broken shaft is the result. By this means the vibrations are taken up and distributed throughout the length of the shaft.

The Bed is "hooded" at the cylinder end, thereby securing great strength and rigidity.

The Eccentric-Rod Pin, which connects the eccentric-rod with the valve-stem guide, is so made that by removing a nut the pin can be withdrawn and end of eccentric-rod lowered, so that the valve may be removed from steam-chest without disconnecting the eccentric-strap.

The Stuffing Boxes for piston-rod and valve-stem are of the well-known locomotive type, consisting of gland, secured and adjusted by two studs with hexagon nuts. This method is far superior to the common arrangement of nut and thread used by some builders, as the threads corrode and strip off, after which it is next to impossible to repair them.

The Cylinder is of the improved "overhung" type, and is cased with a non-conducting hot-air jacket to economize the use of steam by preventing, as far as possible, loss of heat through radiation and consequent condensation of steam in the cylinder. The "overhung" cylinder, as adopted on our engines, has the following advantages: A cylinder attached to the end, instead of the top, of a bed-plate brings the strains directly on a line with the center of crank-shaft, hence there is little or no tendency to buckle the bed while the engine is working; with the old style of "box-bed" there is a tendency to spring the bed and work it loose upon the foundation, more especially where the foundation is at all elastic or unsound. This objection is satisfactorily overcome in our style of bed. Another advantage of the "overhung" cylinder is: The expansion and contraction of its various parts may proceed without interruption, because it is held only by one end. A cylinder may also be changed and a new one substituted, without disturbing the main bed; or, in case a larger cylinder is to be placed upon the same bed, as is desirable under certain conditions, it may easily be done; and all parts are readily accessible for examination or repairs, which features do not obtain to such a degree in other styles of engines.

The Piston and Valve-Rods are of steel.

Every Engine is run with Steam at our Works and thoroughly tested under a full load. After a satisfactory test the packing is removed from the stuffing-boxes, the Engine taken apart and wiped and thoroughly oiled, to insure reliable working conditions upon arrival at its destination.

AUTOMATIC CUT-OFF ENGINES.

The engraving represents our improved medium speed Automatic Cut-off Stationary Engine, which is especially designed for use in mills and electric light and power plants, where close regulation and economy of steam are required, without the expense and care of a high speed engine.

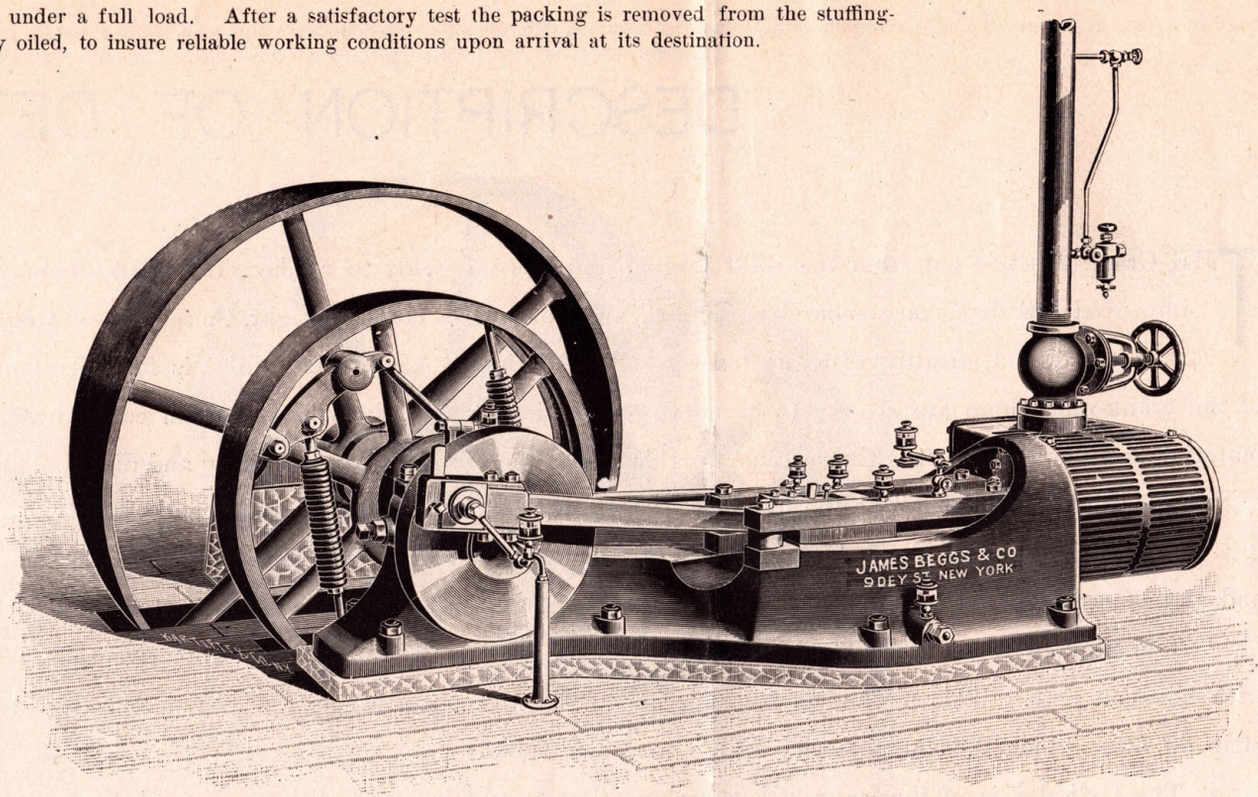
For isolated electric light plants, where the service is constant, the low price and fine regulation of the Engine make it particularly desirable.

The governor is simple in construction, and is exceedingly sensitive to the changes in duty required of the Engine.

The ports are nearly equal in length to the diameter of the cylinder, and are so located as to insure perfect drainage.

The main pillow-blocks are long and fitted with our patent equalizing quarter-boxes.

All working parts are extra large; the crank-pin, piston and valve-rods are steel; and the engine is thoroughly well made throughout.

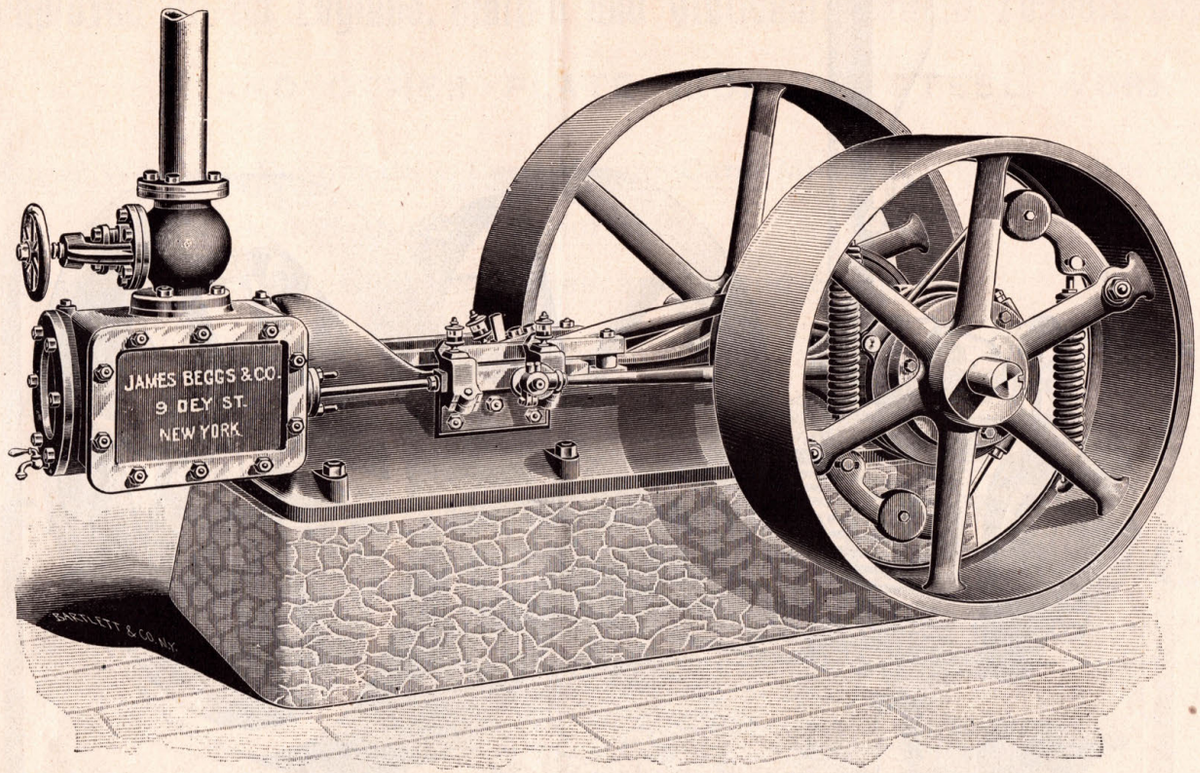


SPECIFICATIONS OF ENGINES.

Number of Size		1	2	3	4	5	6	7	8	9	10
Rated Horse-Power (at 40 lbs. M. E. P. and ¼ cut-off)		**45**	**55**	**70**	**85**	**100**	**130**	**180**	**225**	**300**	**350**
Revolutions per minute		200	200	200	200	180	180	160	150	140	130
Diameter of Cylinder by Length of Stroke	in inches	**10x15**	**11x15**	**12x16**	**13x16**	**14x18**	**16x18**	**18x22**	**20x24**	**22x28**	**24x30**
Diameter of Crank-Shaft	"	4⅞	5¼	5¾	6⅜	6⅞	7½	8½	10	11	12
Diameter of Crank-Pin	"	2½	2¾	3	3¼	3½	4	4½	5	5½	6
Diameter by Length of Main Shaft Bearings	"	4⅞x11	5¼x11	5¾x13	6⅜x13	6⅞x14	7½x15½	8½x18	10x20	11x22	12x24
Diameter of Steam Pipe	"	3	3½	4	4	4½	5	6	6	7	8
Diameter of Exhaust Pipe	"	3½	4½	5	5	5	6	7	7	8	9
Length of Shaft from center of Engine	in feet	6	6	7	7	7½	8	8½	9½	10	11¼
Length of Engine Bed	"	7¼	7¼	8	8	8¾	9	10½	12	13½	14¾
Width of Engine Bed	in inches	29¾	29¾	35½	35½	38	40½	55	56	58	61
Diameter of Governor Wheel	"	42	42	48	48	48	54	60	66	72	78
Face of Governor Wheel	"	10½	10½	12½	12½	12½	12½	14½	18½	18½	20½
Diameter of Band-Wheel	"	54	54	60	60	72	78	84	96	108	120
Face of Band-Wheel	"	12½	12½	14½	14½	16½	20½	24½	30½	36½	42½
Shipping Weight, in pounds	about	5,000	5,350	6,700	7,000	8,900	11,100	20.150	30,200	35,000	42,200
Engine, with Regular Fixtures		$	$	$	$	$	$	$	$	$	$

The Regular Fixtures comprise: Automatic Oiling Device for Crank-Pin and Cross-Head; Large Size Continuous Sight-Feed Cylinder Lubricator; Full Set Sight-Feed Oil Cups; Drips from Cylinder; Two Band-Wheels, turned and balanced, per specifications; and Throttle-Valve.

Every Engine is run with Steam at our Works, and thoroughly tested under a full load to insure reliable working conditions upon arrival at its destination.



AUTOMATIC CUT-OFF ENGINES.

The engraving represents our improved medium speed Automatic Cut-off, Self-contained ("Center-Crank") Engine, which is especially designed for use where good regulation and economy of steam are required, without the expense and care of a high speed engine.

For electric light and power stations in mills, factories or stores where the service is constant, the fine regulation and comparatively low cost of the engine make it particularly desirable.

The governor is simple in construction, and is exceedingly sensitive to the changes in duty required of the engine.

The ports are nearly equal in length to the diameter of the cylinder, and are so located as to insure perfect drainage.

The main pillow-blocks are long, and fitted with our patent equalizing quarter-boxes.

All working parts are extra large; the crank is a solid forging, and the piston and valve-rods are steel; the Engine is thoroughly well made throughout.

SPECIFICATIONS OF ENGINES.

Number of Size		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Rated Horse-Power (at 40 pounds M. E. P. and ¼ cut-off)		**12**	**15**	**20**	**25**	**30**	**35**	**45**	**55**	**70**	**85**	**100**	**130**
Revolutions per minute		240	210	210	210	200	200	200	200	200	200	200	180
Diameter of Cylinder by Length of Stroke	in inches	**6x9**	**7x10**	**8x10**	**8x12**	**9x12**	**10x12**	**10x15**	**11x15**	**12x16**	**13x16**	**14x16**	**16x18**
Diameter of Crank-Shaft	"	2⅜	2⅝	2⅞	3	3⅜	3⅝	3⅞	4⅜	4⅞	4⅞	5⅜	5⅞
Diameter of Crank-Pin	"	2¼	2½	2⅝	2¾	3⅛	3½	3¾	4¼	4¾	4¾	5⅜	5⅞
Diameter by Length of Crank-Shaft Bearings	"	2⅜x5½	2⅝x6	2⅞x6	3x7	3⅜x7½	3⅝x8½	3⅞x8½	4⅜x9	4⅞x10	4⅞x10	5⅜x12	5⅞x14
Diameter of Steam-Pipe	"	1½	2	2½	2½	3	3	3	3½	4	4	4½	5
Diameter of Exhaust-Pipe	"	2	2½	3	3	4	4	4	4½	5	5	6	6
Whole Length of Crank-Shaft	"	40	42	44	47	49	53	59	61	65	65	71	80
Size of Band-Wheel, diameter by face	"	44x7½	48x8½	48x8½	48x10½	54x10½	54x10½	54x12½	54x12½	60x14½	60x14½	66x16½	78x20½
Size of Governor-Wheel, diameter by face	"	30x8½	30x8½	34x8½	34x 8½	36x 8½	40x10½	42x10½	42x10½	48x12½	48x12½	48x12½	54x12½
Shipping Weight, in pounds	about	1,700	2,100	2,500	2,900	3,900	4,300	5,100	5,600	6,900	7,200	8,500	11,700
Engine with Regular Fixtures		$	$	$	$	$	$	$	$	$	$	$	$

The Regular Fixtures comprise: Automatic Oiling Device for Crank-Pin and Cross-Head; large size continuous Sight-Feed Cylinder Lubricator; Full Set Sight-Feed Oil Cups; Drips from Cylinder; Two Band-Wheels, turned and balanced, per specifications; and Throttle-Valve.

Every Engine is run with Steam at our Works, and thoroughly tested under a full load. After a satisfactory test the packing is removed from the stuffing-boxes, the Engine taken apart and wiped and thoroughly oiled, to insure reliable working conditions upon arrival at its destination.

HIGH SPEED AUTOMATIC CUT-OFF ENGINES.

These engines are especially designed for electric light and power plants.

The beds are well proportioned and very strong, and are provided with patent pillow-blocks with an improved form of gib to allow for taking up the wear. The gib is adjusted by a set screw tapped through the solid bed, and provided with a ball and socket joint, to allow for perfect adjustment while the engine is running.

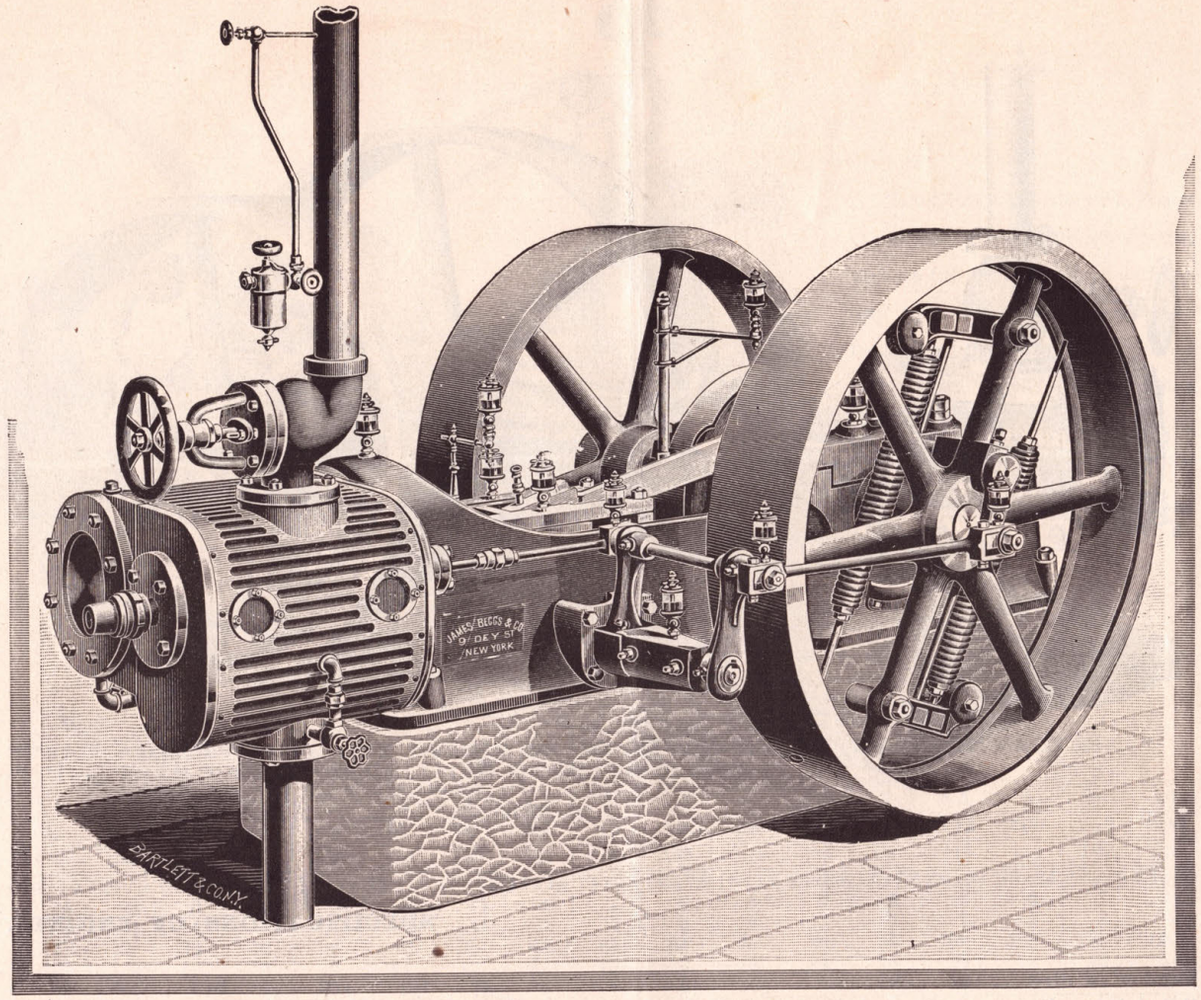
The steam chest is made detachable from the cylinder. The valve is large and simple in its construction, is provided with water grooves for packing, is accurately fitted and perfectly balanced.

The governor is very sensitive and insures close regulation.

The rocker is made with a take-up gib on one side, and has two strong arms through which a steel shaft is passed.

The engine is well built and well proportioned throughout, and careful tests prove it to be one of the best high speed engines now on the market.

Every engine is thoroughly tested under steam; the valves adjusted by indicator, and the regulation assured by autograph recording instruments.

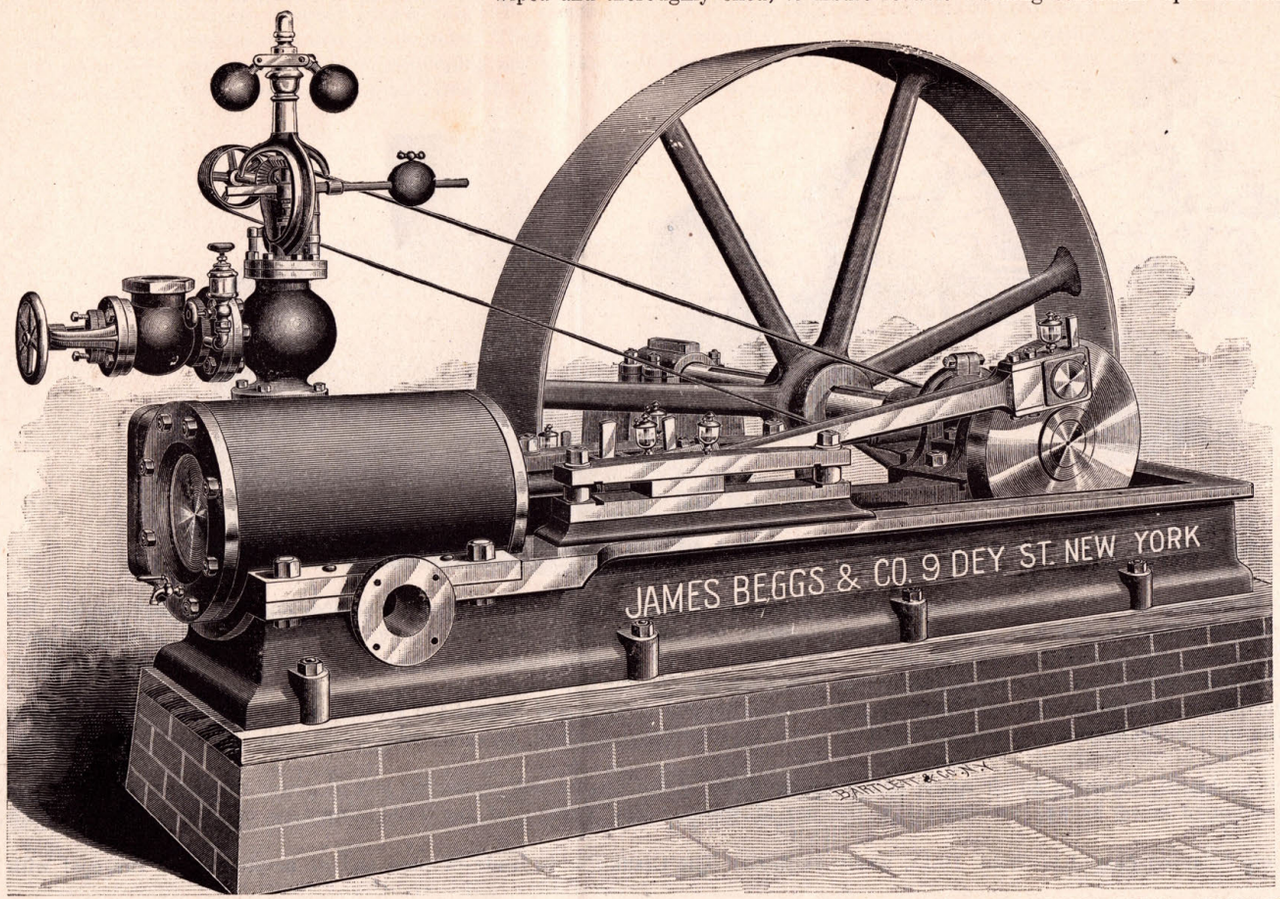


SPECIFICATIONS OF ENGINES.

Number of Size	1	2	3	4	5	6	7	8
Rated Horse Power (at 40 lbs. M. E. P. and ¼ cut-off)	**30** to **35**	**38** to **45**	**50** to **60**	**60** to **73**	**70** to **88**	**85** to **100**	**100** to **125**	**120** to **150**
Revolutions per minute	300 to 350	300 to 350	275 to 325	275 to 325	275 to 325	275 to 325	250 to 300	250 to 300
Diameter of Cylinder by Length of Stroke ..... in inches	**8x10**	**9x10**	**10x12**	**11x12**	**12x12**	**13x12**	**14x14**	**15x14**
Diameter of Crank-Shaft and Crank-Pin ..... "	3½	3½	4¼	4¼	4¾	4¾	5½	5½
Diameter of Steam-Pipe ..... "	2½	3	3½	3½	4	4½	5	5
Diameter of Exhaust-Pipe ..... "	3½	3½	4	4½	4½	5	6	6
Floor space occupied ..... "	90x55	90x55	114x66	114x66	114x75	114x75	126x80	126x80
Size of both Band-Wheels, diameter by face ..... "	48x9½	48x9½	54x10½	54x10½	54x12½	54x12½	60x14½	60x14½
Weight of Band-Wheels in the rough, each ..... in pounds	1,220	1,220	2,100	2,100	2,500	2,500	3,200	3,200
Shipping Weight, in pounds ..... about	5,700	5,800	7,300	7,600	9,900	10,400	14,500	15,000
Engine with Regular Fixtures	$	$	$	$	$	$	$	$

The Regular Fixtures comprise: Nickel-plated Automatic Oiling Device for Crank-Pin and Cross-Head; Nickel-plated Crank Shield; large size continuous Sight-Feed Cylinder Lubricator; full set Sight-Feed Oil Cups; Drip connections from Cylinder and Steam Chest; full set Steel case-hardened Wrenches; Two heavy Band-Wheels, turned and balanced, per specifications; and Throttle-Valve.

Every Engine is run with Steam at our Works, and thoroughly tested under a full load. After a satisfactory test the packing is removed from the stuffing-boxes, the Engine taken apart and wiped and thoroughly oiled, to insure reliable working conditions upon arrival at its destination.



STATIONARY ENGINES, WITH BOX BED.

These engines are made with jacketed cylinders, locomotive slides, and steel piston and valve rods and crank pins. The beds are heavy, the wearing surfaces large, and all working parts are strong and well proportioned. All the fly-wheels and band-wheels are turned and balanced.

In ordering, state whether right or left hand engine is wanted; the engraving shows a left-hand engine.

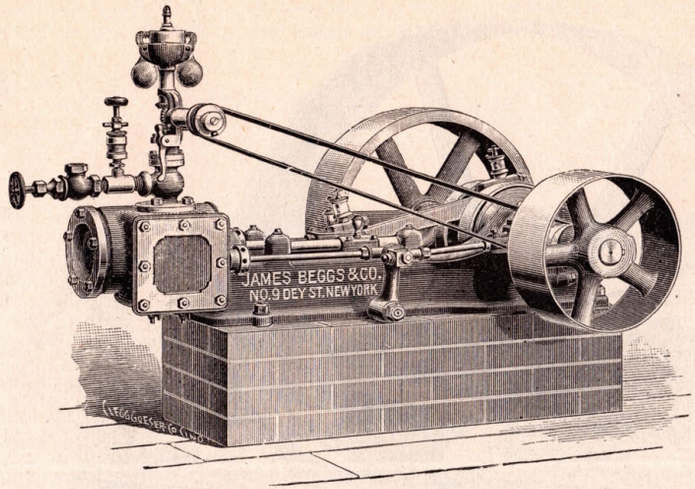
The Regular Fixtures comprise: Continuous Sight-Feed Cylinder Lubricator; Oil-Cups; Drips from Cylinder; Improved Governor, with Patent Automatic Safety-Stop Attachment (which effectually prevents the running away of engine) and Adjustable Speeder; Throttle-Valve; and Band-Wheel, turned and balanced, per specifications.

This Governor is sensitive and accurate, enabling a close adjustment and superior regulation of speed under varying conditions of load and steam pressure.

SPECIFICATIONS OF BOX-BED STATIONARY ENGINES.—BUILT ONLY TO ORDER.

Number of Size	**6**	**9**	**11**	**12**	**13**	**14**	**15**
Horse Power, as usually rated	**40**	**55**	**90**	**100**	**125**	**150**	**200**
Usual Number of Revolutions	150	125	125	125	125	125	125
Diameter of Cylinder by Length of Stroke ..... in inches	**10x20**	**12x24**	**14x30**	**16x24**	**18x24**	**20x24**	**20x30**
Diameter of Crank-Shaft ..... "	4⅝	5⅜	6½	6½	7	8	8
Diameter of Crank-Pin ..... "	2½	3	3½	4	4½	5	5
Diameter by Length of Main Shaft Bearings ..... "	4⅝x9½	5⅜x12	6½x12½	6½x13½	7x13½	8x15	8x15
Diameter of Steam Pipe ..... "	3	3½	4	5	5	6	6
Diameter of Exhaust Pipe ..... "	4	4½	5	6	6	7	7
Length of Bed Frame ..... in feet	11½	13½	16⅓	13¼	13¼	13¼	17
Width of Bed Frame ..... in inches	22	25	29	27½	27½	27½	31
Length of Crank-Shaft from center of Engine ..... in feet	7	7	8	8	8	8	8
Size of Band-Wheel, diameter by face	96x15	96x15	120x17	96x17	96x19	96x19	120x21
Shipping Weight, in pounds ..... about	7,100	10,000	16,000	13,000	14,500	17,000	21,000
Engine, with Regular Fixtures	$	$	$	$	$	$	$
FLY-WHEELS AND SMALL BAND-WHEELS FOR ABOVE ENGINES SUBSTITUTED FOR THE REGULAR BAND-WHEELS, WHEN SO ORDERED, AT THE ADDITIONAL PRICE.							
Diameter of Fly-Wheel ..... in inches	108	110	120	120	120	120	120
Diameter of Small Band-Wheel ..... "	48	60	60	60	60	60	60
Face of Small Band-Wheel ..... "	15	15	17	17	19	21	21
Price, additional	$	$	$	$	$	$	$

Every Engine is run with Steam at our Works, and thoroughly tested under a full load, before being shipped, to insure reliable working conditions upon arrival at its destination.



HORIZONTAL, SELF-CONTAINED ("CENTER CRANK") STEAM ENGINES.

In calling attention to the merits of these Engines, we believe they offer in their present perfection all advantages attainable in Center-crank or self-contained Engines. They are all that good design, best material and workmanship can make them; they are symmetrical and well proportioned, with plenty of metal to insure steady and quiet operation at their rated speed, and present a handsome appearance. They may be relied upon to easily develop the power we claim for them. The Engine, in all respects, is all that good material and workmanship can make it, and is suitable for any purpose requiring small power, from one to seven horse, especially for running small Dynamos for Electric Lighting.

The Frame is designed so as to secure at once strength and proper distribution of metal, with symmetry of shape and beauty, and present the greatest resistance in the line of motion between the Cylinder and Crank-shaft, and furnishing with itself both of the bearings which are babbitted with the best anti-friction metal, and perfectly square with the other working parts of the Engine.

The Cylinder is jacketed or lagged with metal which is nickel-plated, enclosing an air space, adding to the finish of the Engine and preventing loss of power through radiation. The ports are large and well proportioned, so as to develop the largest amount of power as well as economy in the use of steam. The Valve is of the well-known type of slide valve, and both valve and seat are scraped to a perfect fit.

The Crank-Shaft is made of steel and is very large, having balanced face plate Crank Disks, nicely finished. The Crank-Pin is made of steel and of ample size to run cool with the heaviest load.

The Connecting-Rod is made of steel, and is fitted with brass boxes of the best mixture for Engine purposes, and is very easily adjusted.

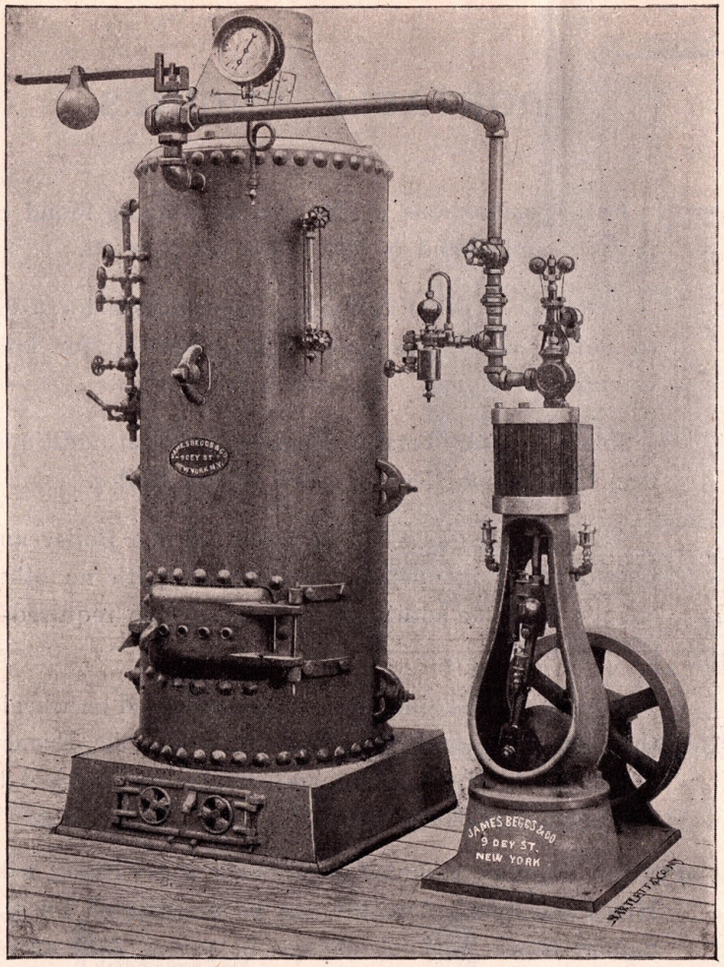
The Cross-Head is made of brass and has a steel Pin turned perfectly round and true. There are two holes parallel with each other that fit the slide, and are easy of adjustment. The Slides are made of round steel, and are fitted in perfect alignment with the Cylinder.

The Piston is made hollow so as not to have any more weight than is absolutely necessary to insure strength and has two metallic packing rings, sprung on the Piston. The Eccentric-Valve and Piston-Rods are all of polished steel, making a very fine finish.

Number of Size	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Horse-Power, as usually rated	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Usual Number of Revolutions, per minute	55	110	160	220	300	220	260
Diameter of Cylinder by Length of Stroke, in inches	**4x6**	**4x6**	**4x6**	**4x6**	**4x6**	**5x6**	**5x6**
Diameter of Steam Pipe, "	¾	¾	¾	¾	¾	1	1
Diameter of Fly-Wheel Pulley, "	18	18	18	18	18	20	20
Face of Fly-Wheel Pulley, "	4	4	4	4	4	5	5
Diameter of Crank-Shaft, "	2⅛	2⅛	2⅛	2⅛	2⅛	2⅛	2⅛
Shipping Weight, in pounds, about	425	425	425	425	425	450	450
Engine, with Regular Fixtures	$	$	$	$	$	$	$

The Regular Fixtures comprise: Lubricator; Oil Cups; Drips to Cylinder, for relieving the Engine of water; Governor and Fly-Wheel Pulley of the proper size and weight to insure steady motion.

Every Engine is run with Steam at our Works, and thoroughly tested under a full load before being shipped, to insure reliable working conditions upon arrival at its destination.



"MONTAUK" VERTICAL STEAM ENGINES.

SELF-CONTAINED.

These Engines are of superior construction, being manufactured with great care, from the best materials, and the workmanship is of the best quality, all the parts being fitted in a thorough and workmanlike manner. The steam joints are scraped and ground to a perfect bearing, thus obviating the annoyance of gum or paper joints. The Shaft, Piston-Rod, Valve-Rod and Cross-Head Pin are made of forged steel. The Cross-Head is fitted with composition gibs that are adjustable (to take up the wear). The Piston is fitted with Spring-Rings. All the moving parts are evenly balanced, thus assuring steadiness and smooth running.

These Engines are finely finished, and the parts are made interchangeable, and are easy of access for adjustment or repairs They are all that good work and good material can possibly make them, to be durable.

These Engines are adapted for any manufacturing purpose, and especially where floor space and room are an object. They do not require expensive foundations, and can be placed upon the ordinary floor without annoyance to persons on other floors. Regularity of speed is guaranteed under all variations of load and steam pressure.

SPECIFICATIONS OF ENGINES AND BOILERS, COMBINED.

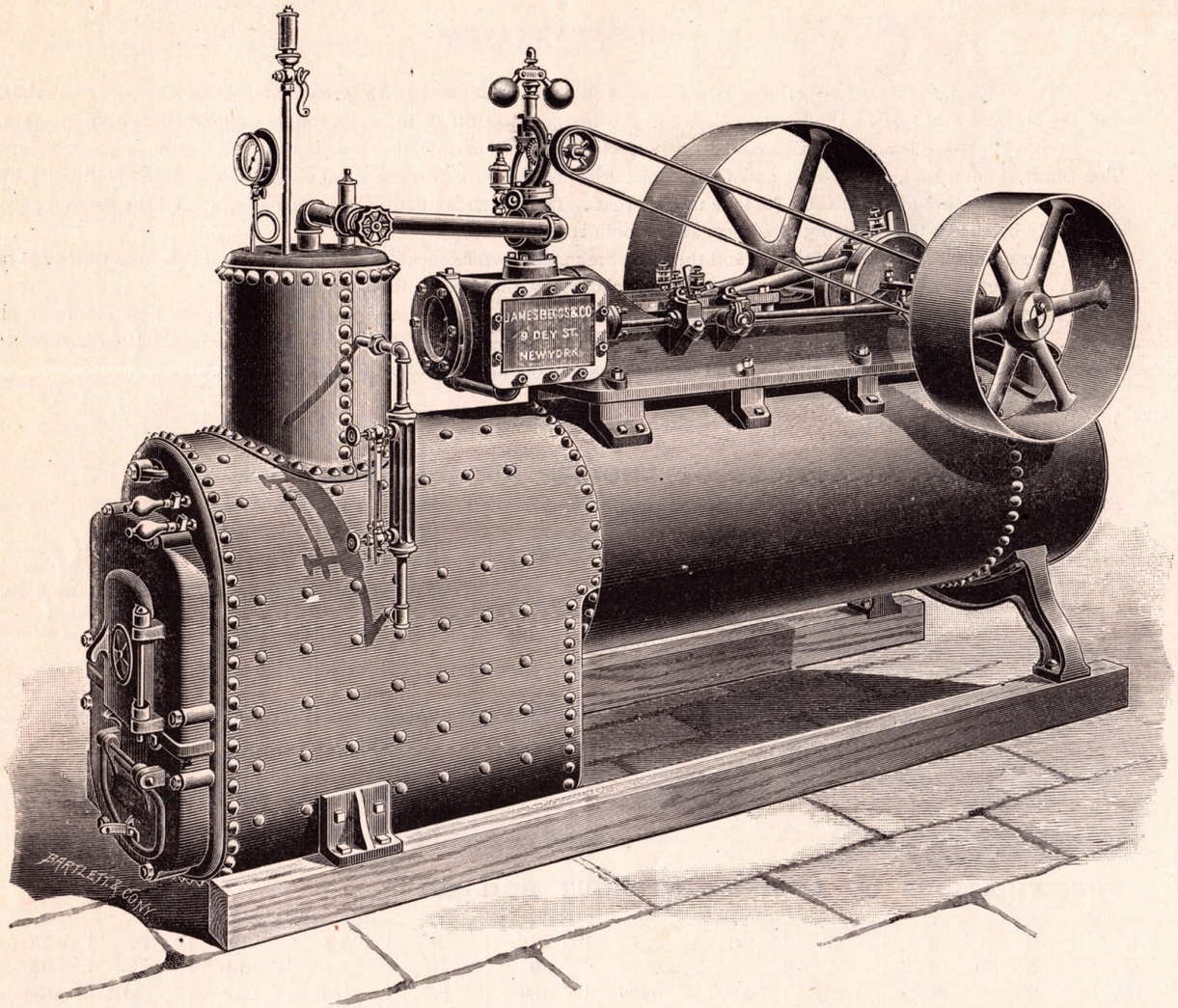
Horse-Power as Usually Rated.	Size of Cylinder.		Size of Boiler.		Floor Space, Inches.	Weight, Complete.	Price of Engine and Boiler Complete, as Shown.
	Diameter, Inches.	Stroke, Inches.	Diameter, Inches.	Height, Feet.			
3	3	4	24	4	24x42	1,500	$
4	4	5	24	5	30x48	1,750	
5	5	6	24	6	38x60	2,700	
6	6	6	30	5	38x60	2,950	
7	6	7	30	5	38x60	3,100	
9	7	7	30	6	45x80	4,300	
10	7	8	30	7	45x80	4,500	

SPECIFICATIONS OF ENGINES, WITHOUT BOILERS.

Number of Size	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Horse-Power, as usually rated	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**9**	**10**	**14**	**20**	**25**	**35**
Usual Number of Revolutions, per minute	85	165	250	200	200	180	180	180	170	180	170	180	150
Diameter of Cylinder by Length of Stroke ..... in inches	**2⅛x2½**	**2¾x3½**	**3x4**	**4x5**	**5x6**	**6x6**	**6x7**	**7x7**	**7x8**	**8x8**	**9x9**	**10x12**	**12x12**
Diameter of Crank-Shaft ..... "	1 11/16	1 11/16	1 11/16	1 13/16	1 15/16	1 15/16	1 15/16	2 7/16	2 7/16	2 15/16	2 15/16	3⅞	3⅞
Diameter of Steam-Pipe ..... "	½	½	½	¾	1	1¼	1¼	1½	1½	1½	2	2½	3
Diameter of Exhaust-Pipe ..... "	1	1	1	1	1¼	1½	1½	2	2	2	2½	3	3½
Floor Space ..... "	14x24	14x24	14x24	16x28	20x34	20x34	20x34	22x39	22x39	25x45	31x55	36x60	36x60
Height ..... "	37	37	37	44	54	54	57	63	63	68	78	88	88
Size of Fly-Wheel Pulley, diameter by face ..... "	18x3½	18x3½	18x3½	20x4	24x5	24x5½	28x5½	32x6	32x6	34x8	38x10	42x10	42x12
Shipping Weight, in pounds ..... about	285	300	325	400	700	850	900	1,600	1,700	1,800	2,700	4,000	4,400
Engine, with Regular Fixtures	$	$	$140	$166	$196	$208	$218	$265	$285	$330	$450	$580	$670

The Regular Fixtures comprise: Continuous Sight-feed Cylinder Lubricator; Oil-Cups; Drips to Cylinder; Governor; and Fly-Wheel Pulley.

A Low Water Detector and Alarm is fitted to each boiler. This appliance is reliable, extremely simple, and cannot be tampered with when the boiler is in operation. It is a means of preventing costly damage to boiler when the water becomes dangerously low, by allowing the steam to escape and give alarm ; so permanent injury is prevented and the boiler may be left in good condition. This style of DETECTOR has been approved by the United States Board of Supervising Inspectors of Steam Vessels, Navy Department, Washington, D. C., and is required by them on all boilers under their control.



PORTABLE ENGINES.

Full specifications of the Engine will be found on pages 4 and 5, and of the Boiler on page 24.

The price of Portable Engine includes Injector, fitted to Boiler, and balance of regular fixtures for both Engine and Boiler.

Nos. 8 and 9, Portable Engines, have an additional stand for supporting the shell of the Boiler.

All these Engines can be taken off the Boiler and placed on an independent foundation, with no other change than the additional lengths of pipe required—See page 13.

When these Engines are ordered mounted on wheels, the Tongue is furnished; but the Neck-yoke, Evener, Whiffletrees, Hand-Pump and Brake are subject to order, and are charged extra.

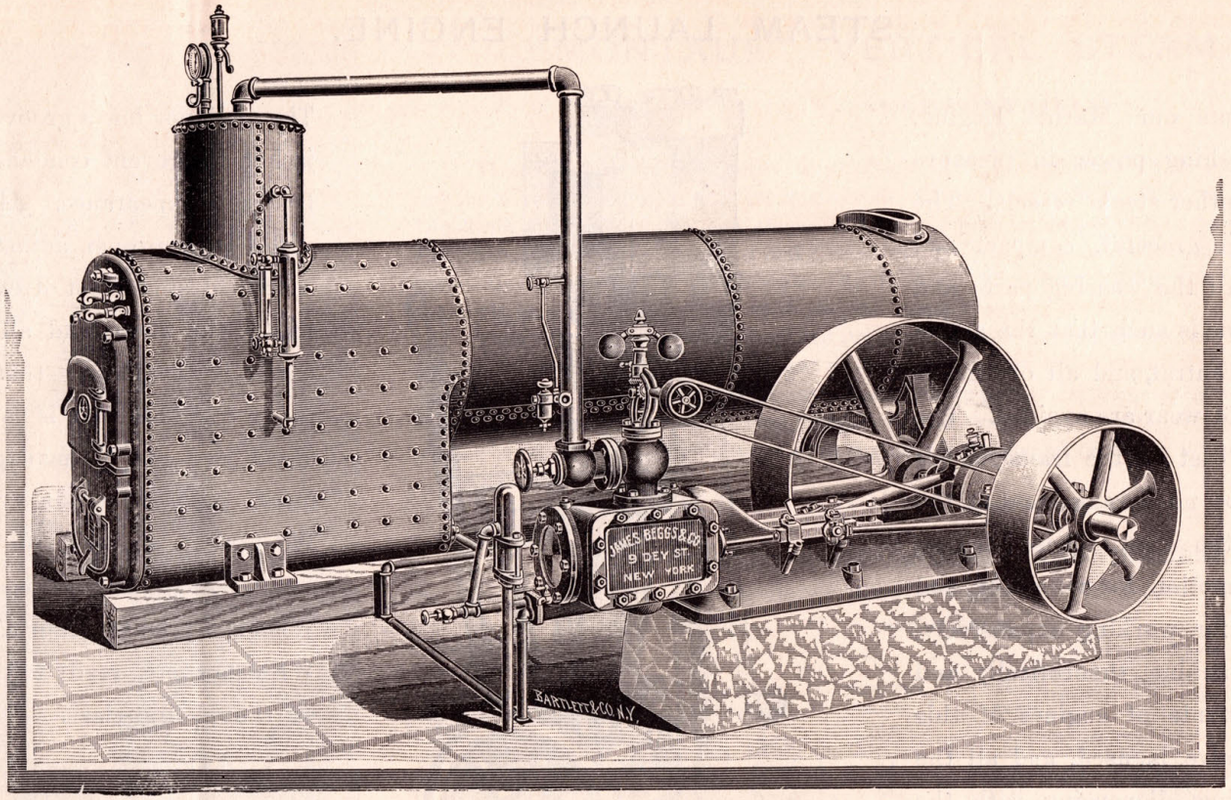
For Engines mounted on wheels a short Stack, with Hinge and Spark Arrester, can be substituted for the regular Stack, without change in price; but, unless otherwise ordered, we send the regular Stack.

SPECIFICATIONS OF PORTABLE ENGINES.

Number of Size	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Horse-Power, as usually rated	**8**	**10**	**12**	**15**	**20**	**25**	**35**	**40**	**50**
Usual number of revolutions	200	175	175	150	150	150	150	150	150
Diameter of Cylinder by Length of Stroke ...in inches	**6x9**	**7x10**	**8x10**	**8x12**	**9x12**	**10x12**	**10x15**	**11x15**	**12x16**
Diameter of Boiler ... "	28	30	32	32	34	36	40	40	44
Weight, complete, in pounds ... about	5,000	6,000	6,400	7,600	9,200	10,500	13,500	15,000	18,500
Price	$	$	$	$	$	$	$	$	$

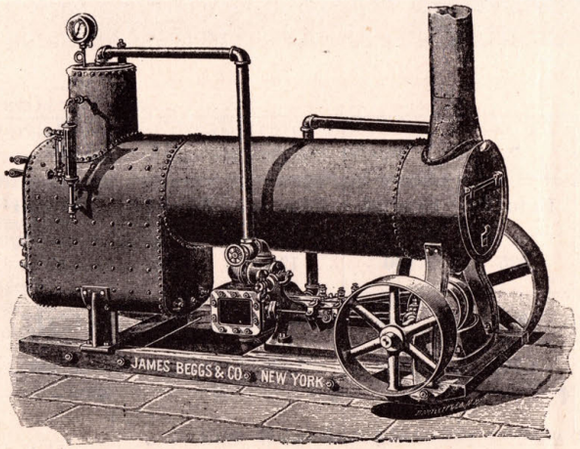
Every Engine is run with Steam at our Works, and thoroughly tested under a full load, to insure reliable working conditions upon arrival at its destination.

Every Engine and Boiler is thoroughly tested under Steam at our Works before being shipped, to insure reliable working conditions upon arrival at its destination.



"WATER-BOTTOM" PORTABLE BOILER, AND SELF-CONTAINED ("CENTER-CRANK") ENGINE,

WITH CONNECTING STEAM AND WATER PIPES.



UNDER-MOUNTED PORTABLE ENGINE.

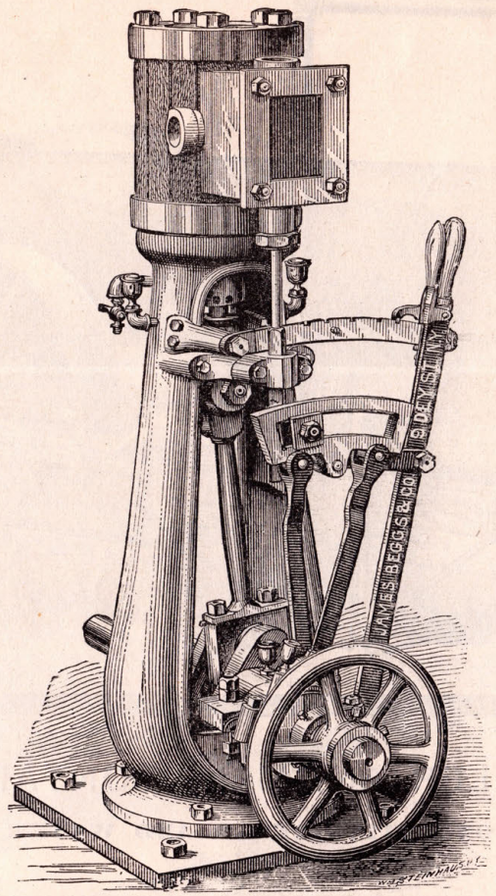
The Engines can be set on an independent foundation, as shown above, and connected to any style of boiler—"Portable," Stationary" or "Vertical."

A Low Water Detector and Alarm is fitted to each boiler. This appliance is reliable, extremely simple, and cannot be tampered with when the boiler is in operation. It is a means of preventing costly damage to boiler when the water becomes dangerously low, by allowing the steam to escape and give alarm; so permanent injury is prevented and the boiler may be left in good condition. This style of DETECTOR has been approved by the United States Board of Supervising Inspectors of Steam Vessels, Navy Department, Washington, D. C., and is required by them on all boilers under their control.

Every Engine is run with Steam at our Works and thoroughly tested under a full load, before being shipped, to insure reliable working conditions upon arrival at its destination.

STEAM LAUNCH ENGINE.

This engraving represents our Marine Engine, which is adapted to furnishing power in pleasure yachts, tug-boats, canal and other steam vessels. The frames of these engines are graceful, compact and strong, with easy access to all the wearing parts, and the construction of the Engine is such that the action of the piston-rod is exactly central, and all overhanging strains and unevenness of wear are avoided. The bearings are large, and are cast on the frame, as are also guides, and there can be no derangement of the parts or unequal pressure of the same. These Engines are furnished with the link motion, for reversing, and are provided with notches for working expansively, and are justly claimed to combine, theoretically and practically, all the requirements of engines of this character. A plain slide valve is used, and all the steam joints are ground, thus dispensing with the annoyance of rubber or gum packing. The Shaft, Piston-Rod, Valve-Rod and Cross-head Pin are of Steel, and the Connecting-Rod of the best refined iron.



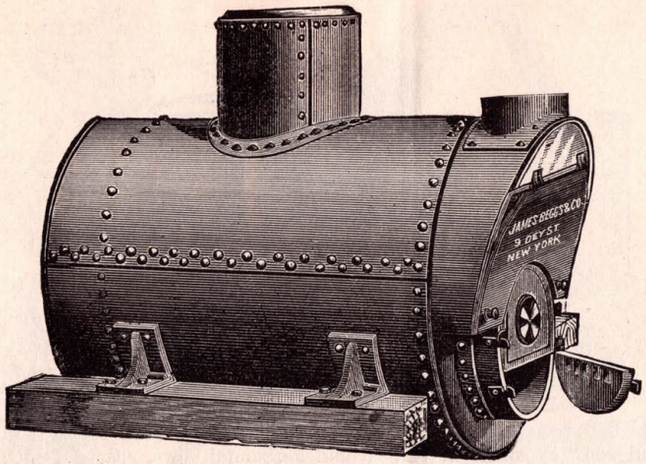
The Cylinder has a grooved and tongued black walnut jacket, to prevent condensation, which also gives it a beautiful appearance. All the wearing parts are provided with proper adjustments to take up the wear. A critical steam test of every Engine is made before it leaves the shop, and all necessary adjustments are carefully made, so that when shipped it is all ready for work. It is very simple and easily understood, and can be managed by any one of ordinary intelligence. The sizes range from $3\frac{1}{4} \times 5$ to 12×12. We furnish an eccentric pump at a small additional cost. Every Engine is furnished with a Pry-over Wheel, Cylinder Lubricator, Drip Cocks, Oil Cups, Wrenches, etc., ready to place in boat. Every Engine warranted first-class.

Price of Shafting, Propeller and other machinery furnished on application.

SPECIFICATIONS OF YACHT ENGINES.

Number of Size	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Horse-Power, as usually rated	**3** to **5**	**4** to **6**	**5** to **8**	**6** to **9**	**7** to **10**	**10** to **14**	**12** to **16**	**15** to **20**	**18** to **25**	**25** to **30**	**35** to **40**	**45** to **50**
Usual number of revolutions, per minute	300	300	275	275	275	250	225	225	200	175	175	175
Diameter of Cylinder by Length of Stroke, in inches	3¼x5	3¾x5	4x6	5x6	5¾x6	7x7	7½x8	8x8	9x9	10x12	11x12	12x12
Height from Floor to top of Cylinder..... "	38	39	42	42	43	55	57	58	63	80	80	81
Weight, complete, in pounds.. .....about	300	325	400	425	450	700	1,075	1,170	1,350	2,500	3,000	3,500
Price of Engine	$	$	$	$	$	$	$	$	$	$	$	$

These Boilers are designed (unless otherwise specified) to carry a working pressure of 100 pounds of steam to the square inch, and are subjected to a thorough test by us, before delivery, under a steam pressure of about 120 pounds. They are carefully inspected by the Hartford Steam Boiler Inspection and Insurance Co., and tested by (warmed) water pressure to the extent of 150 pounds per square inch without developing any weakness or defects, and insured by them for one year. The certificate of inspection and test, signed by the Company's Inspector, also policy of insurance, will be furnished customer free of charge. This policy is payable to the purchaser, and will be in force and valid wherever the boiler is located.



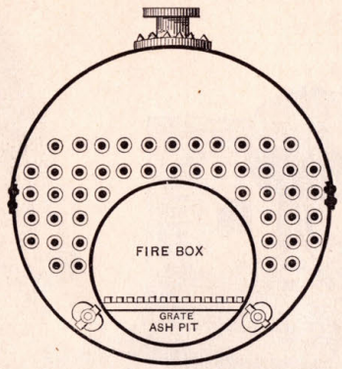
THE CLYDE BOILER.—Probably no form of horizontal boiler used in launches combines in so great a degree, strength, compactness and low centre of gravity as the form of boiler illustrated herewith, which we call the "Clyde" boiler.

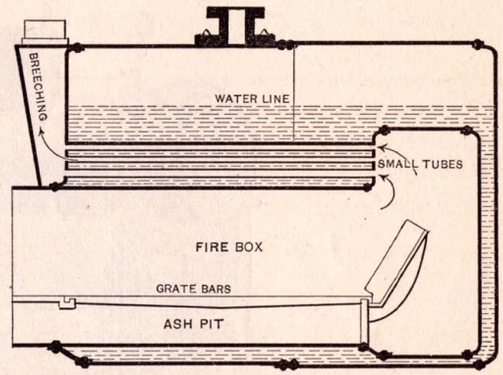
As will be seen by the engraving, all the surfaces of the fire-box and the shell of the boiler are cylindrical, this being the strongest form in which the material can be put together. The fire-grate is placed in the large central tube, and the fire is entirely surrounded by water. The "Clyde" is a return-flue boiler. The fire passes through the large central tube into a lined combustion chamber at the rear of the boiler, and returns through the smaller tubes to the smoke bonnet at the front end of the boiler, thence into the funnel, thus giving the greatest possible economy in the use of fuel. The tubes are at all times below the water line.

Diameter. Inches.	Length. Inches.	Diameter, Furnace. Inches.	Square Feet Heating Surface.	Suitable for Engine Cylinder.	Price, with Regular Fixtures.
40	50	18	90	5x 7	$
44	56	20	115	6x 8	
48	68	22	185	7x 8	
48	72	24	185	8x 8	
54	72	26	230	8x10	
54	84	26	285	9x 9	
60	84	28	325	10x10	
60	96	28	400	10x12	
72	96	30	500	12x12	

The Regular Fixtures comprise: Steam-Gauge, Water-Gauge, Gauge-Cocks, Safety-Valve, Blow-Off Cock, Grate-Bars, Smoke-Stack and Breeching.

Boilers of this style smaller than we list are objectionable because the furnace is too small.





SCOTCH MARINE BOILERS (with Water-Backs).—In large boats, where economy of fuel has to be considered, or where the boat is desired for long trips, and the weight of fuel to be carried is an object of consideration, we would recommend the form of Scotch boiler of which we show outlines, which is built with a water-back. The cost of these boilers is considerably in excess of the other type ("Clyde") and in small launches the saving in fuel will not warrant the extra expense.

All material and work conforming to U. S. Marine laws for *high-pressure* steam, with fittings to correspond in quality and service.

The Regular Fixtures comprise: Breeching, Grate-Bars, Smoke-Stack, Steam-Gauge, Water-Gauge, Gauge-Cocks, Safety-Valve and Blow-Off Cock.

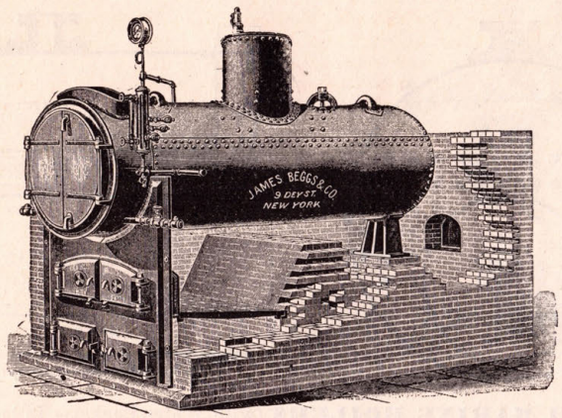
Shell.		Square Feet Heating Surface.	Approximate Weight all Complete.	Price, with Regular Fixtures.
Diameter.	Length.			
50	72	185	4,650	$
50	84	230	5,100	
54	72	240	5,350	
60	72	303	7,000	
60	84	320	7,500	
60	96	375	8,500	
66	72	400	8,500	
72	96	530	12,700	
72	108	600	13,800	
78	108	825	16,000	

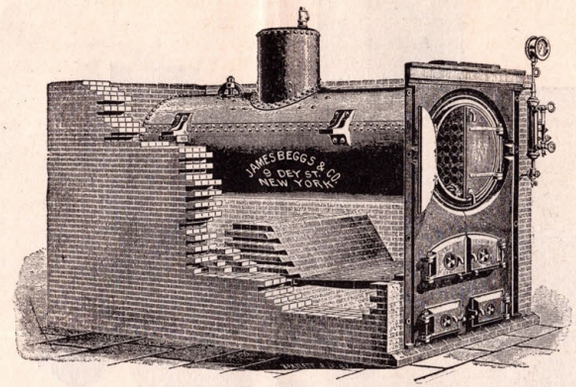
Orders for marine boilers should always contain the following information:

1. Location and name of waters on which boat is to run.
2. Kind of fuel to be used.
3. All orders for marine boilers must be accompanied by the name of the boat in which the boiler is to be placed and also, where practicable, the hailing port.

A Low Water Detector and Alarm is fitted to each Boiler. This appliance is reliable, extremely simple, and cannot be tampered with when the boiler is in operation. It is a means of preventing costly damage to boiler, when the water becomes dangerously low, by allowing the steam to escape and give alarm, so permanent injury is prevented, and the boiler may be left in good condition. This style of **Detector** has been approved by the **United States Board of Supervising Inspectors of Steam Vessels, Navy Department, Washington, D. C.,** and is required by them on all boilers under their control.

A Low Water Detector and Alarm is fitted to each boiler. This appliance is reliable, extremely simple, and cannot be tampered with when the boiler is in operation. It is a means of preventing costly damage to boiler when the water becomes dangerously low, by allowing the steam to escape and give alarm; so permanent injury is prevented and the boiler may be left in good condition. This style of **Detector** has been approved by the United States Board of Supervising Inspectors of Steam Vessels, Navy Department, Washington, D. C., and is required by them on all boilers under their control.





We use lap-welded boiler tubes **of standard thickness and quality.** The tubes are set with a "Dudgeon" expander in vertical and horizontal rows, spaced 1 inch apart, and the ends of tubes project beyond heads of boiler about one-quarter inch, and are "flared" but not beaded over.

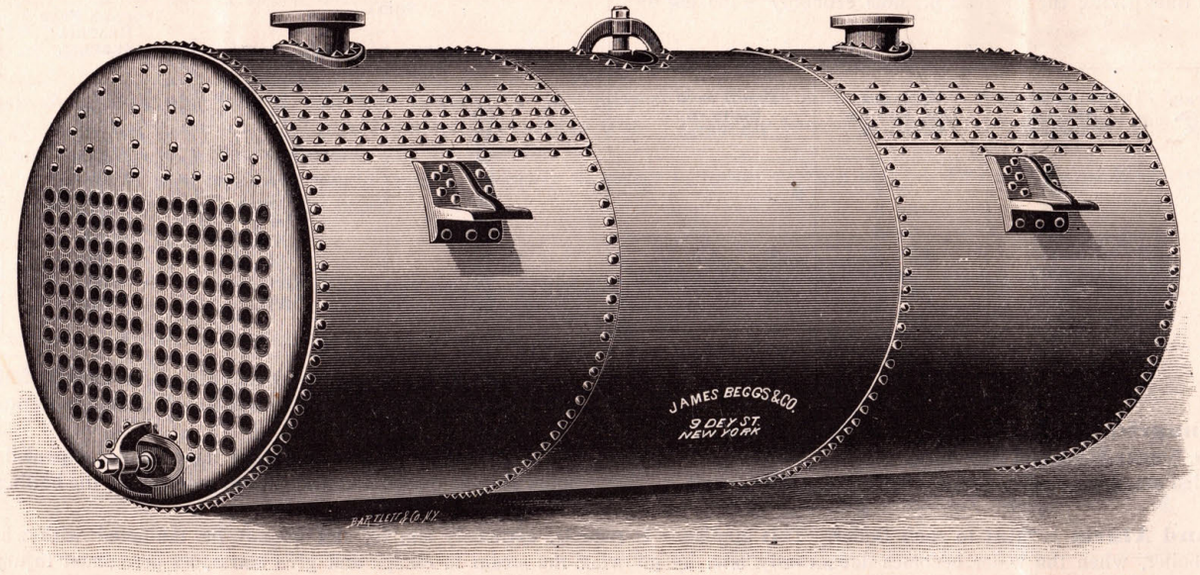
No. 10 and larger boilers have a circulating space of 2 or more inches left, vertically, through center line of tubes; and no tubes are nearer the shell than 2 inches, and at bottom of boiler tubes are not less than 8 inches from the shell.

A cast-iron neck is securely riveted to top of each boiler, with opening for pipe of suitable size.

No. 9 and smaller boilers have manhole formed in front head, above tube line. All larger sizes have manhole in top of shell.

No. 17 and smaller boilers have 4½x6 inch hand-hole cut in each head, below tube line. All larger sizes have manhole instead of hand-hole, in front head; and hand-hole in rear head, below tube line.

Our side lugs are extra large size, with heavy rib through centre line; and are firmly secured to boiler.



Provision is made on each of these boilers for attaching the most approved system of "feed" and "blow-offs."

These Boilers are designed (unless otherwise specified) to carry a working pressure of 100 pounds of steam to the square inch, and are subjected to a thorough test by us, before delivery, under a steam pressure of about 120 pounds. They are carefully inspected by the Hartford Steam Boiler Inspection and Insurance Co., and tested by (warmed) water pressure to the extent of 150 pounds per square inch without developing any weakness or defects, and insured by them for one year. The certificate of inspection and test, signed by the Company's Inspector, also policy of insurance, will be furnished customer free of charge. This policy is payable to the purchaser, and will be in force and valid wherever the boiler is located.

HORIZONTAL RETURN-TUBULAR STATIONARY STEAM BOILERS.

Our Boilers are made throughout of Open-hearth Homogeneous "Best Flange" Steel Plate, of 60.000 pounds tensile strength, with an elastic limit of over 30,000 pounds, elongation of over 20 per cent., and reduction of area of 45 to 50 per cent. This steel will turn over and close down solid without fracture, when cold, or after heating and cooling in water, and will not blister. The shells of Nos. 1, 2, 3 and 4 are formed of a single plate; Nos. 3½, 5, and larger sizes, up to and including No. 15, have one plate in the bottom and one in the top; Nos. 16 and 17 have bottom of one plate about 9 feet wide and one or more plates in the upper section. In all sizes up to and including No. 17, the bottom of boiler will be without seams, except around the heads. The great advantages of a boiler made in this way are apparent; there are no seams over the fire, and the bottom presents a smooth, even surface, which greatly facilitates cleaning, prevents lodgment of sediment, and consequent burning of plates. The longitudinal seams of the Shell are double-riveted, with calking edge looking upwards. The rivets are spaced in accordance with the most approved rules, and the greatest possible strength secured at the seams. The edges of the plates are planed and the calking is done by Connery's patent concave system. Special attention is given to the bracing, which is a most important item in boiler construction. All our boilers, up to and including No. 3½, are braced with solid stay-rods, running from head to head, screwed in place and riveted over on outside of head. All larger boilers are braced throughout with solid "crow-foot" braces. All stay-rods and braces are made of a special refined iron of 50,000 pounds tensile strength, and enough braces are used to insure a large factor of safety. Care is used in locating braces that they do not come in way of entering boiler, or of feed and blow-off pipes which enter through top of shell.

SPECIFICATIONS OF BOILERS.

Number of Size	**1**	**2**	**3**	**3½**	**4**	**5**	**6**	**7**	**7½**	**8**	**9**	**10**	**10½**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Horse-Power, as usually rated	**10**	**12**	**15**	**20**	**20**	**25**	**30**	**35**	**40**	**40**	**45**	**50**	**60**	**60**	**70**	**80**	**90**	**100**	**125**	**150**	**175**	**200**	**225**	**250**	**300**	**325**	**350**
Diameter of Boiler ....in inches	**30**	**30**	**36**	**36**	**42**	**42**	**44**	**44**	**44**	**48**	**48**	**54**	**54**	**60**	**60**	**60**	**66**	**66**	**72**	**72**	**78**	**84**	**90**	**96**	**102**	**108**	**108**
Length of Tubes used....in feet	7	8	8	10	8	10	10	12	14	12	14	12	15	12	14	16	15	16	16	18	18	18	18	18	18	18	20
Number of Tubes, 3-in. diameter	20	20	28	28	38	38	46	46	46	52	52	64	64	82	82	82	98	98	120	84	88	108	132	150	166	190	190
Square Feet Heating Surface....about	151	185	220	288	305	376	440	526	611	591	687	708	880	885	1028	1172	1296	1377	1660	4″ tbs	4″ tbs	4″ tbs	4″ tbs	4″ tbs	4″ tbs	4″ tbs	4″ tbs
Length of Grates....in inches	36	36	36	42	36	42	42	48	54	48	54	48	54	48	54	54	54	54	54	60	60	60	72	72	72	78	84
Thickness of Shell .... "	¼	¼	¼	¼	9/32	9/32	9/32	9/32	9/32	5/16	5/16	5/16	5/16	11/32	11/32	11/32	3/8	3/8	7/16	7/16	7/16	7/16	1/2	1/2	17/32	9/16	9/16
Thickness of Main Heads .... "	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	7/16	7/16	7/16	7/16	7/16	7/16	7/16	7/16	7/16	1/2	1/2	1/2	1/2	1/2	1/2	17/32	9/16	9/16
Weight of Boiler and Breeching....about	1900	2300	2600	2900	3500	4000	4300	4900	5500	6000	6800	7000	8200	9000	9900	11000	12700	13000	16000	17300	21000	25000	30000	32000	36000	39000	41000
Weight of Boiler Fixtures.... "	1500	1600	1700	1950	2200	2500	2600	2700	3000	3400	3500	3600	3800	4000	4500	5000	5000	5000	6000	6200	7000	8000	9000	10000	11000	12000	12000
Weight of Boiler and Fixtures....about	3400	3900	4300	4850	5700	6500	6900	7600	8500	9400	10300	10600	12000	13000	14400	16000	17700	18000	22000	23500	28000	33000	39000	42000	47000	51000	53000
Weight of Boiler with 4 Wall Brackets....about	1800	2200	2500	2800	3300	3900	4300	5000	5500	5700	6500	7000	8000	8600	9700	10500	12000	13000	16000	17400	21000	24700					
Weight with Flush Front and Fixtures....about	4400	4900	5300	5800	7000	7700	8400	9000	10000	10200	11500	12000	13500	14500	16000	17000	19000	20000	24000	25000	30000	35000					
Boiler, with Regular Fixtures	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$

The Regular Fixtures comprise: Arch Front, of neat design, with two furnace doors provided with cast-iron perforated lining plates; Dead Plate; Anchor Bolts, to hold the front to mason work; Door with Frame, for cleaning boiler at rear end of mason work; Plates and Rollers, for lugs to ride on in side walls of mason work; Grate Bars, with suitable Bearer; Heavy Ribbed Buck-stays, for binding side walls of mason work, and Anchor Bolts, running across top and bottom, with Nuts and Washers for same; L Bar, for supporting top of arch against rear end of boiler; Safety-Valve; Gauge-Cocks; Steam-Gauge; and Gauge-Glass, with Water-Column.

The width of the grate surface in all cases equals the diameter of the boiler. Sawdust grates, six inches longer than regular, will be substituted for the regular grates, when ordered, without extra charge.

SMOKESTACKS FOR ABOVE BOILERS FURNISHED, WHEN SO ORDERED, AT ADDITIONAL PRICE.

Diameter of Smokestack....in inches	14	14	16	16	20	20	22	22	22	24	24	26	26	28	28	28	30	30	34	36	40	44	48	50	54	56	56
Length of Smokestack....in feet	28	28	28	35	28	35	35	40	50	40	50	40	50	40	50	60	60	60	60	60	60	60	60	60	60	60	60
Price of Smokestack	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$

All Smokestacks up to and including 28 inches in diameter are made of No. 16 iron; 30, 32 and 34 inches in diameter of No. 14, and 36 inches and larger of No. 12. If heavier iron is required a proportionate charge will be made.

When two or more boilers, up to No. 7½ in size, are placed in a battery and designed to run separately, the fronts, smoke connection, etc., are arranged for a 16-inch division wall; boilers up to No. 10½, 20-inch, and larger sizes 24-inch division wall. Any deviation from the above must be noted in order.

CHANGE IN NUMBER AND SIZE OF TUBES WITHOUT CHANGE IN PRICE.

Number of Size	**1**	**2**	**3**	**3½**	**4**	**5**	**6**	**7**	**7½**	**8**	**9**	**10**	**10½**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
No. of 3-in. Tubes, with Hand-hole in each Head below tubes	20	20	28	28	38	38	46	46	46	52	52	64	64	82	82	82	98	98	120	...	....	....	....	....	....	....	....
" 3 " " Manhole in front " "	...	....	20	20	30	30	40	40	40	46	46	58	58	78	78	78	94	94	116	...	....	....	....	....	....	....	....
" 3½ " " Hand-hole in each " "	16	16	22	22	30	30	36	36	36	42	42	50	50	64	64	64	78	78	96	104	...	....	...	...	....	....	....
" 3½ " " Manhole in front " "	....		18	18	26	26	32	32	32	38	40	46	48	60	60	60	76	76	94	100	....	....	...	....	....	..	....
" 4 " " Hand-hole in each " "	12	12	18	18	24	24	30	30	30	34	34	42	42	54	54	54	64	64	80	84	....	....	....	....	....	....	....
" 4 " " Manhole in front " "	....	....	14	14	20	20	26	26	26	30	30	38	38	52	52	52	58	58	78	80	88	108	132	150	166	190	190
" 6 " " " " " "	....	..	6	6	10	10	10	10	10	14	14	18	18	22	22	22	30	30	36	36	40	44	62	74	78	92	92

A Low Water Detector and Alarm is fitted to each Boiler. This appliance is reliable, extremely simple, and cannot be tampered with when the boiler is in operation. It is a means of preventing costly damage to boiler, when the water becomes dangerously low, by allowing the steam to escape and give alarm, so permanent injury is prevented, and the boiler may be left in good condition. This style of **Detector** has been approved by the **United States Board of Supervising Inspectors of Steam Vessels, Navy Department, Washington, D. C.,** and is required by them on all boilers under their control.

SMOKE CONNECTIONS.

Fig. C, for two boilers only.

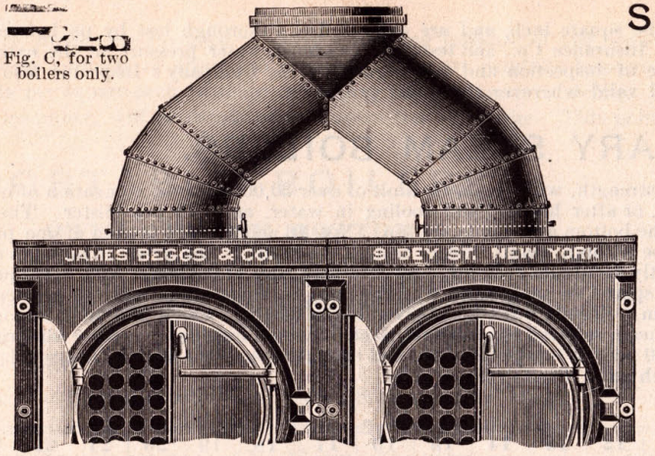
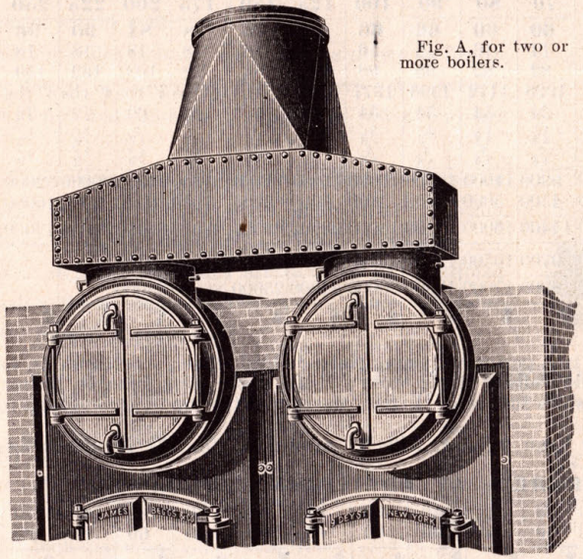


Fig. A, for two or more boilers.



CONNECTIONS FOR BOILERS

up to and including 48 inches in diameter are made of No. 14 Iron; larger sizes of No. 12 Iron.

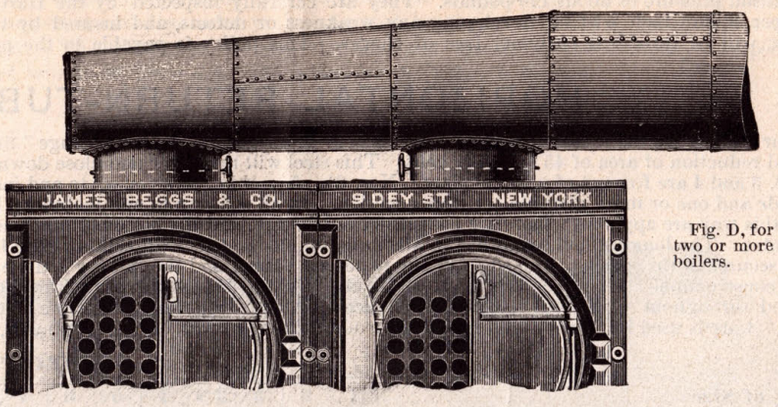


Fig. D, for two or more boilers.

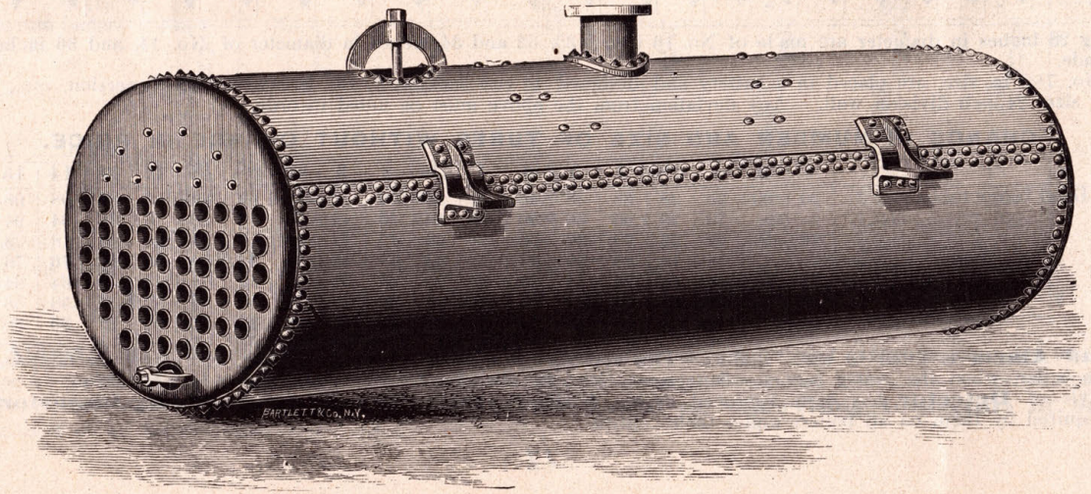
PLAIN GRATE
(STANDARD PATTERN)

With ¼, ½ and ¾ inch opening.

TUPPER OR HERRING-BONE GRATE

With ½-inch opening only.

SAW-DUST AND WOOD GRATE

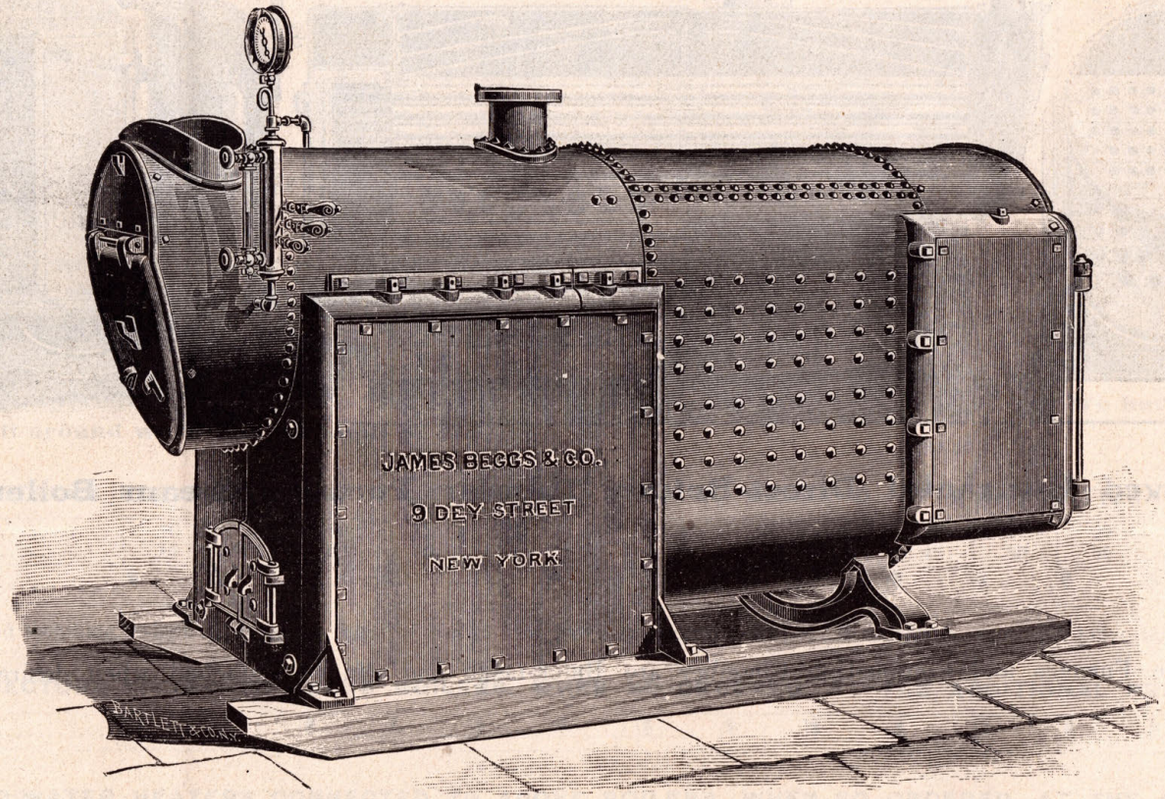


JAMES BEGGS & CO., No. 9 DEY STREET, NEW YORK.

OUR CELEBRATED PATENT IMPROVED HORIZONTAL DIRECT-RETURN TUBULAR PORTABLE STEAM BOILER.

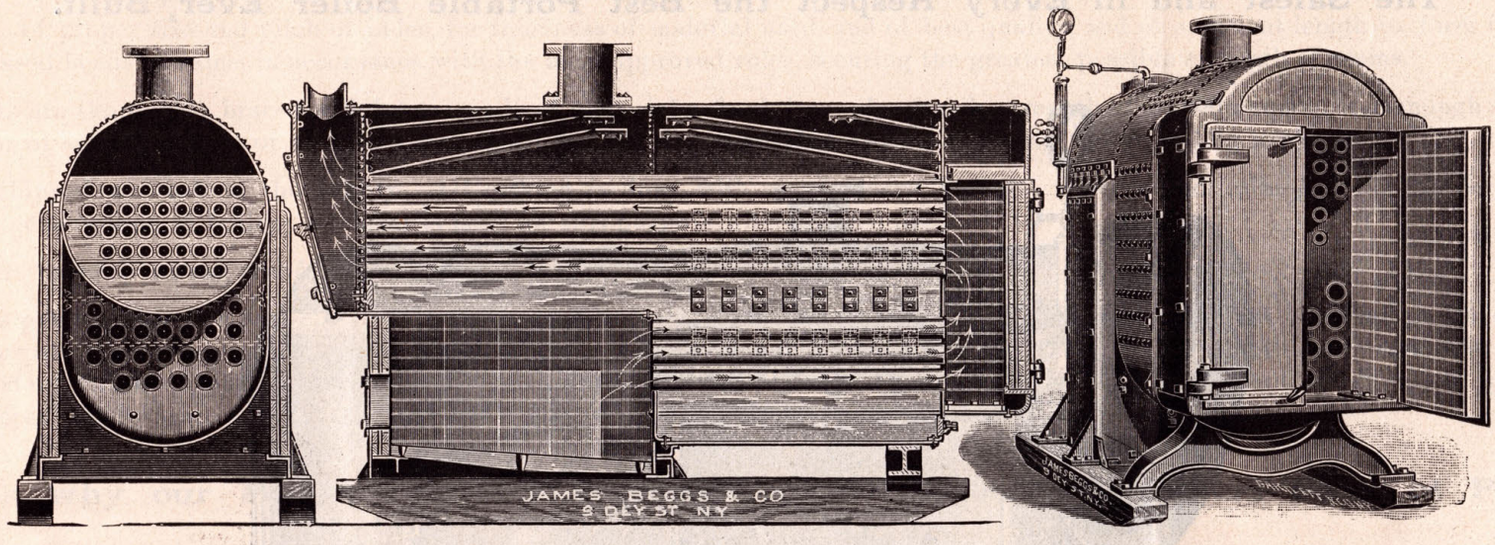
FITTED WITH McCLAVE'S PATENT GRATE-BARS. **(See pages 37 to 43.)**

The Safest and in Every Respect the Best Portable Boiler Ever Built.



It occupies but little space, is a rapid steamer, and combines with the SAFETY of the Stationary Return Tubular Boiler the CONVENIENCE and PORTABILITY of a PORTABLE.

ALL PARTS ARE READILY ACCESSIBLE FOR INSPECTION AND REPAIRS.



Our Patent Improved Horizontal Direct-Return Tubular Portable Steam Boiler—Sectional View.

The Furnace and Combustion Chamber are BRICK-LINED and can be detached when desired.

The Fire Brick Lining of the Furnace and Combustion Chamber insures a very high degree of temperature, more complete combustion of the gases, and consequent economy in fuel than any water-lined furnace.

Pressure: These boilers are designed (unless otherwise specified) to carry a working pressure of 100 pounds of steam to the square inch.

Test: They are subjected to a thorough test by us, before delivery, under a steam pressure of about 120 pounds.

Inspection and Insurance: They are carefully inspected by the Hartford Steam Boiler Inspection and Insurance Company, and tested by (warmed) water pressure to the extent of 150 pounds per square inch without developing any weakness or defects, and insured by them for one year. The certificate of inspection and test, signed by the Company's Inspector; also, Policy of Insurance, will be furnished customers free of charge. This policy is payable to the purchaser, and will be in force and valid wherever the boiler is located.

SPECIFICATIONS OF OUR PATENT IMPROVED BOILERS.

MADE OF HOMOGENEOUS OPEN-HEARTH STEEL PLATE, AND THOROUGHLY BRACED THROUGHOUT.

Number of Size	**00**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**7½**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Horse-Power, as usually rated	**4**	**6**	**8**	**10**	**12**	**15**	**20**	**25**	**30**	**35**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
Diameter of Boiler...in inches	**24**	**24**	**24**	**28**	**28**	**30**	**30**	**36**	**36**	**40**	**40**	**44**	**50**	**54**	**54**	**60**	**60**
Length of Furnace, inside... "	30	30	35	35	35	38	44	44	44	53	53	53	60	60	60	60	66
Width " " ... "	24	24	24	28	28	30	30	36	36	40	40	44	50	54	54	60	60
Number of 3-inch tubes	10	12	12	16	16	21	21	30	30	38	38	52	64	78	78	88	88
Length " " used...in feet	4	5	6	6	7	7	8½	8	9	9	10	9½	9½	9	10	9½	11
Number of 4-inch tubes	6	7	7	10	10	12	12	18	18	20	20	26	32	42	42	46	46
Length " " used...in inches	15	27	34	35	46	43	55	49	61	52	64	58	54	48	60	54	66
Thickness of Shell... "	No. 4	No. 4	No. 4	No. 4	No. 4	¼	¼	¼	¼	9/32	9/32	5/16	5/16	5/16	5/16	11/32	11/32
Thickness of Tube Sheets... "	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	7/16	7/16
Length of Boiler, over all, in feet...about	7½	8½	9½	9½	10½	10½	12	11½	12½	13	14	13½	13½	13	13½	13½	15½
Width " " " ... "	3½	3½	3½	4	4	4	4	4½	4½	5	5	5½	6	6½	6½	7	7
Height " " " ... "	5½	5½	5½	5½	5½	6	5½	6	6½	6½	6½	7½	8	8½	8½	9	9
Weight of Boiler...about	3,200	3,600	4,000	4,500	4,750	6,000	6,450	7,800	8,400	9,200	10,300	11,800	14,100	17,000	17,900	20,800	22,500
Weight of Fixtures... "	500	550	600	700	750	750	1,000	1,100	1,200	1,500	1,700	1,900	2,160	2,300	2,400	2,700	3,000
Weight of Boiler and Fixtures...about	3,700	4,150	4,600	5,200	5,500	6,750	7,450	8,900	9,600	10,700	12,000	13,700	16,200	19,300	20,300	23,500	25,500
Boiler with Regular Fixtures...	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$

The Regular Fixtures comprise: Grates; Steam-Gauge; Gauge-Glass; Gauge-Cocks and Safety-Valve. A Water-Column, in connection with the gauge-glass, is furnished with each boiler. The height of water can thus be determined with greater certainty and ease, and the chances of accident are lessened.

Each Boiler is provided with Pipes and Elbows (on inside) for "feed" and "surface blow-off."

The Furnace is fitted with McClave's Patent Grate-Bars, and the grate surface is very much larger in proportion to the heating surface than any other Portable Boiler—thus permitting the use of a very cheap grade of coal. ☞ **See pages 37 to 43.** ☜ **We have evidence which proves these grate-bars the very best for all-around work and all kinds of fuel.**

SMOKESTACKS FOR ABOVE BOILERS FURNISHED, WHEN SO ORDERED, AT THE ADDITIONAL PRICE.

Diameter of Stack	10	10	10	12	12	14	14	18	18	20	20	22	24	28	28	30	30
Length of Stack	15	24	30	30	35	35	40	40	45	45	50	50	50	45	50	50	60
Price of Stack	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$

All smokestacks up to and including 28-inch diameter are made of No. 16 iron, and larger sizes of No. 14; if heavier is required a proportionate charge will be made.

INJECTORS FITTED TO ABOVE BOILERS, WHEN SO ORDERED, AT THE ADDITIONAL PRICE.

Price of Injector, fitted to boiler	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$

PUMPS AND FEED-WATER HEATERS CONNECTED TO ABOVE BOILERS, WHEN SO ORDERED, AT THE ADDITIONAL PRICE.

Price of Pump and Feed-Water Heater, connected to boiler	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$

STEAM WHISTLES CONNECTED TO ABOVE BOILERS, WHEN SO ORDERED, AT THE ADDITIONAL PRICE.

Price of Whistle, connected to boiler	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$

WORKMANSHIP.

The tubes are set with a "Dudgeon" Expander.

All girth seams are single riveted. All horizontal seams of the shells of No. 6 and larger sizes are double riveted.

All rivets are of proper size and pitch of holes, for thickness of material used, and of best quality, and of sufficient length to form up heads equal in strength to the pressed heads of same, in accordance with the most approved rules, securing the greatest possible strength at seams.

These Boilers are thoroughly braced with braces made of a special refined iron, of a tensile strength of 50,000 pounds, and enough braces are used to insure a large factor of safety. Edges of all plates are planed to a bevel, and finished ready for calking, before rolling to shape.

Seams are chipped and calked thoroughly. All calking is done with a "Connery Patent" round-nosed calking tool. No drift pins are used to "fair-up" holes in construction of boiler; a reamer is used for this purpose wherever required.

All flanges are properly turned and free from flaws, checks or other defects.

The whole is put together in a first-class workmanlike manner; materials used are the best of their several kinds. Our shops are equipped with the latest and most approved machinery, and the work from beginning to end is done after a thorough system, which enables us to make the best boilers at the lowest prices consistent with good work. Powerful steam cranes are employed for lifting and carrying the heavy plates through the shops, and for loading the completed boilers; this insures careful handling.

Reasons why our Patent Improved Return Tubular Boiler is the Best Form of Portable Boiler that is Made.

The mere assertion that this is THE BEST PORTABLE BOILER in the market carries no weight in itself, but we support this claim by the following practical evidence—which is beyond dispute correct.

The design of this boiler is an elaboration, or extension, of the principle of one of the oldest and best forms of the MARINE DIRECT-FLUE RETURN TUBE BOILER, which has long been recognized as the most economical in the use of fuel.

In addition to the advantages of the Horizontal Tubular Boiler, this has, instead of direct flues, a number of short 4-inch tubes which contain more heating surface than flues, so that a better opportunity is given at once to transmit the heat of the gases directly to the water as they leave the furnace. The 4-inch tubes being short, these gases are not extinguished as they pass out into the rear combustion chamber, and by reason of the fire-brick lining (which becomes incandescent soon after the fire is started), these gases sustain little or no loss of heat through radiation, and therefore enter the return tubes much hotter than is possible in other boilers claiming to be as economical as this one. The combustion of the gases is so nearly complete that the products of combustion as they leave the smoke arch are rarely more than 450° F. under proper working conditions, therefore the heat which has disappeared from the gases has passed into the water.

The fire-brick lining prevents radiation of heat, so the gases, enriched by the added oxygen, start off through the long tubes with renewed vigor and at an increased temperature. In passing through these 3-inch tubes, extending the entire length of the shell, the greater portion of heat is extracted and absorbed by the water. These facts must be admitted by every well posted engineer.

Again, in bracing: This boiler is free from the serious objection to the use of short stay bolts for bracing flat surfaces—as, for example, on locomotives it is often found that the upper row, and sometimes rows, of stay bolts are broken off short, caused by the difference in expansion between the side sheets of the furnace and the outside shell. In this boiler there are no side sheets or short stay bolts; but the flat sides are securely held by *solid* "CROW-FOOT" braces, extending from one side of shell to the other, so that no hinging or bending action is brought upon these braces.

In this boiler there is no water leg or water bottom to fill with mud and corrode or burn out. There is no flat crown sheet to act as a receptacle for mud and scale. The front end of the boiler is cylindrical in form and extends over the furnace, forming the crown sheet; the rear end is oval, the lower portion extending below far enough to hold the short tubes leading from the furnace to the back connection.

The shell of this boiler over furnace being circular, is considerably larger and furnishes more heating surface than a flat crown sheet, is always fully protected by water, is very much stronger—and therefore safer—under equal conditions. In the ordinary portable boiler the crown sheet is flat, and, although subjected to the greatest heat, is the first part exposed by low water, and the sides of the furnace are difficult to keep clean and are liable to burn out.

All sediment is, by the natural ebullition of the water, readily washed off the crown sheet into the lowest part of shell, so that by opening the blow-off cock, this dirt quickly passes out.

This boiler has a furnace lined with fire brick, held securely in place by iron rods, which are protected from the fire, and can be removed and replaced when necessary, so that the boiler may be moved from place to place without danger of shaking down these walls.

The surfaces of the fire brick toward center of furnace, when the boiler is fired up, became incandescent and thereby attain a very high temperature, which greatly aids combustion and insures a complete combustion of the gases.

The circulation of water in boilers of the locomotive type, having water legs at the sides of fire box, is very imperfect, and when these water spaces become partially filled with scale and mud, the water is driven out by the intense heat, and the plates being insufficiently protected by water, bulge out, and are often burned or cracked. All water spaces in this boiler are very large, so that the circulation about the tubes and near the bottom is almost perfect.

The sediment settles in the coolest instead of the hottest part of this boiler, which is regarded as an essential element of safety.

Finally, having mentioned briefly the above principal advantages of this over any other form of Portable Boiler, we leave the subject with the statement, that a trial of thousands of these boilers, for years past, establishes, beyond a doubt, their practical utility and that they possess "The Elements of a Permanent Success."

PRESSURE—These boilers are designed (unless otherwise specified) to carry a working pressure of 100 pounds of steam to the square inch.

TEST—They are subjected to a thorough test by us, before delivery, under a steam pressure of about 120 pounds.

INSPECTION AND INSURANCE—They are carefully inspected by the Hartford Steam Boiler Inspection and Insurance Company, and tested by (warmed) water pressure to the extent of 150 pounds per square inch without developing any weakness or defects, and insured by them for one year. The certificate of inspection and test signed by the Company's Inspector; also, Policy of Insurance, will be furnished free of charge.

The Furnace is fitted with McClave's Patent Grate-Bars, and the grate surface is very much larger in proportion to the heating surface than any other Portable Boiler—thus permitting the use of a very cheap grade of coal. ☞ **See pages 37 to 43.** ☜ **We have evidence which proves these grate-bars the very best for all-around work and all kinds of fuel.**

These Boilers are designed to carry a working pressure of 100 pounds of steam to the square inch (unless otherwise specified), and are subjected to a thorough test by us, before delivery, under a steam pressure of about 120 pounds. They are carefully inspected by the Hartford Steam Boiler Inspection and Insurance Co., and tested by (warmed) water pressure to the extent of 150 pounds per square inch, without developing any weakness or defects, and insured by them for one year. The certificate of inspection and test, signed by the Company's Inspector, also policy of insurance, will be furnished customers free of charge. This policy is payable to the purchaser, and will be in force and valid wherever the boiler is located.

PORTABLE BOILERS,

WITH "WATER BOTTOM."

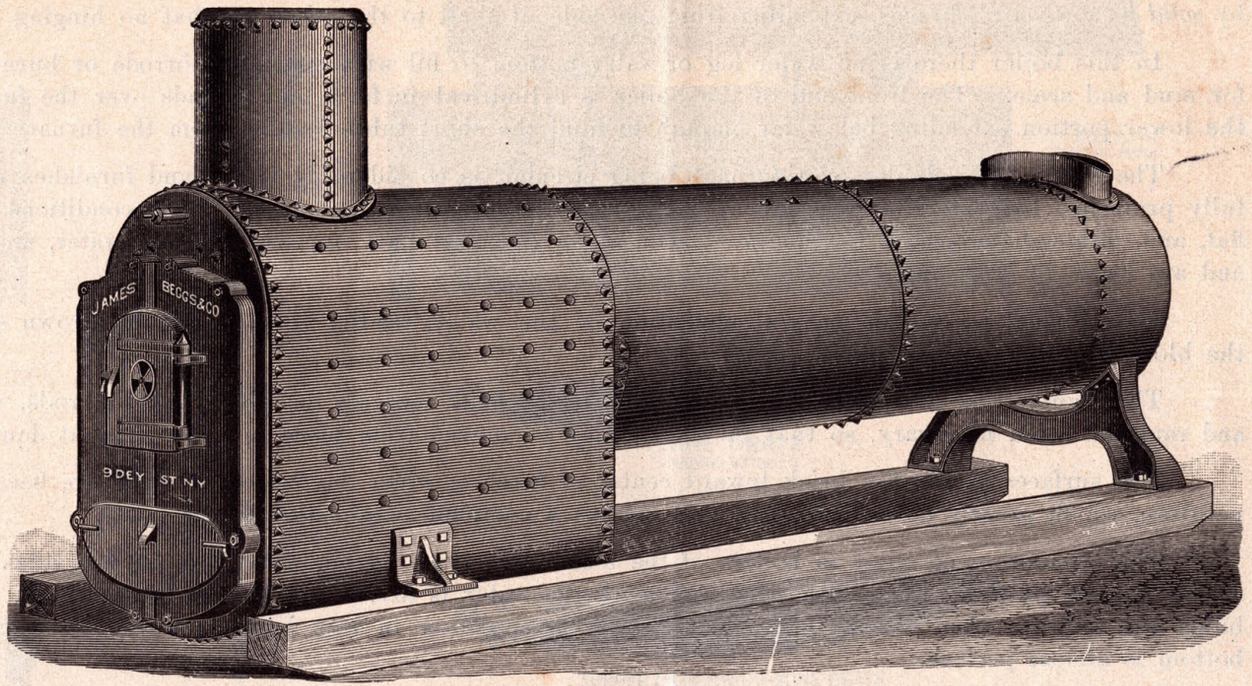
The favorite "Water Bottom" style, made of open-hearth homogeneous steel plate and thoroughly braced and stayed throughout. The longitudinal seams of the shells of No. 6, and all larger sizes, are double riveted.

The Regular Fixtures comprise: Grates; Steam-Gauge; Water-Gauge; Gauge-Cocks; Safety-Valve; Blow-off Cock; and Smoke-stack. All smokestacks are made of No. 16 iron; if heavier is required, a proportionate charge will be made.

When order calls for boiler mounted on wheels, as shown on fourth page of cover, the tongue is furnished; but the neck-yoke, evener, whiffletrees, hand-pump and brake are subject to order, and are charged extra.

Note.—When these boilers are made with water front, as shown on third page of cover, the furnace is about three inches shorter. Water front boilers are made on special order only, and at an extra price.

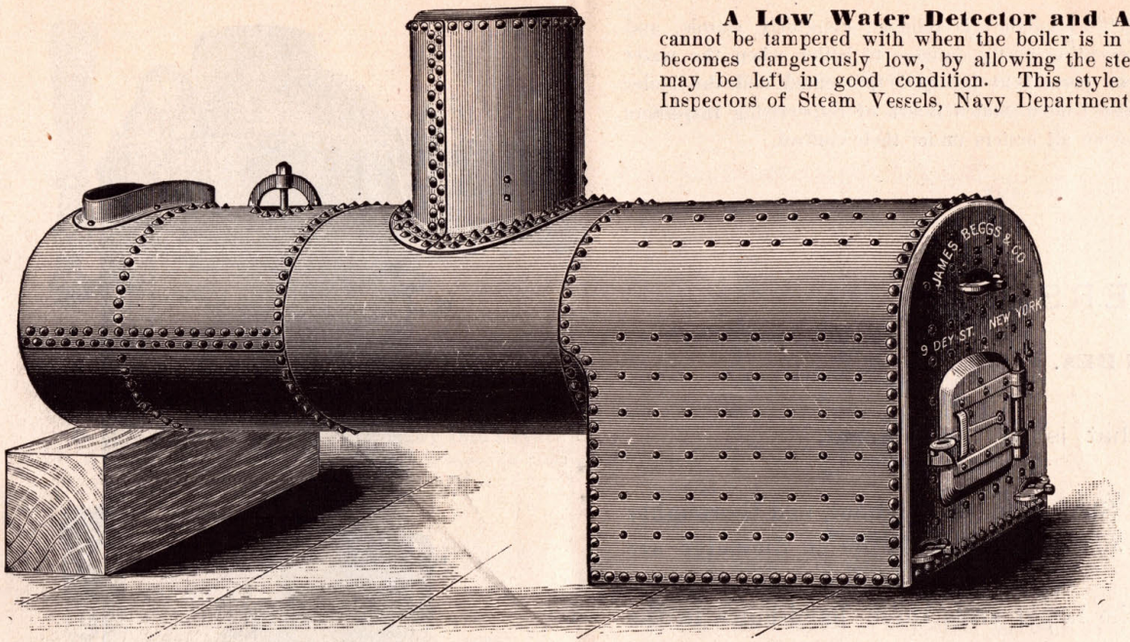
The short stack, with hinge and spark arrester, can be substituted for the regular stack without change in price; but unless otherwise ordered, we send the regular straight stack.



SPECIFICATIONS OF PORTABLE BOILERS WITH "WATER BOTTOM."

Number of Size	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**7½**	**8**	**9**	**10**
Horse-Power, as usually rated	**6**	**8**	**10**	**12**	**15**	**20**	**25**	**30**	**35**	**40**	**50**	**60**
Diameter of Boiler...in inches	**26**	**28**	**30**	**32**	**32**	**34**	**36**	**40**	**40**	**40**	**44**	**48**
Length of Furnace (see note above)... "	34	36	38	38	44	52	52	60	60	60	64	64
Width of Furnace... "	21	22	24	26	26	28	30	34	34	34	38	42
Height of Furnace... "	29	33	35	35	35	37	40	43	43	43	50	52
Number of Tubes (3-inch diameter)...	15	18	20	24	24	28	32	38	40	40	46	52
Length of Tubes used...in feet	5	6	7	6½	7	8	8½	8	9	10½	11½	12
Thickness of Shell and Outside of Fire-Box ...in inches	No. 4	No. 4	¼	¼	¼	¼	¼	9/32	9/32	9/32	5/16	5/16
Thickness of Furnace Plate... "	9/32	9/32	9/32	9/32	9/32	9/32	9/32	9/32	9/32	9/32	5/16	5/16
Thickness of Tube Sheets... "	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
Diameter of Dome... "	12	14	16	18	18	20	20	22	22	22	22	26
Height of Dome... "	15	16	18	20	20	22	22	24	24	24	24	28
Diameter of Stack... "	12	14	14	16	16	16	18	20	20	20	22	22
Length of Stack...in feet	12	12	12	12	12	12	12	12	12	12	12	12
Length of Boiler over all, in feet ...about	9¾	11	12	11¾	13	14½	15	15	16	17⅛	19¼	20
Weight of Boiler, on skids...about	2,600	3,150	3,650	3,900	4,150	5,100	5,900	7,000	7,450	7,950	9,900	11,300
Weight of Boiler Fixtures... "	450	500	550	600	650	950	1,000	1,150	1,250	1,350	1,500	1,700
Weight of Boiler and Fixtures, complete, on skids..about	3,050	3,650	4,200	4,500	4,800	6,050	6,900	8,150	8,700	9,300	11,400	13,000
Weight of Boiler and Fixtures, complete, on wheels..about	3,500	4,100	4,700	5,000	5,300	6,600	7,500	8,700	9,300	9,900	12,000	13,700
Boiler, with Regular Fixtures...	$	$	$	$	$	$	$	$	$	$	$	$

A Low Water Detector and Alarm is fitted to each Boiler. This appliance is reliable, extremely simple, and cannot be tampered with when the boiler is in operation. It is a means of preventing costly damage to boiler, when the water becomes dangerously low, by allowing the steam to escape and give alarm, so permanent injury is prevented, and the boiler may be left in good condition. This style of **Detector** has been approved by the **United States Board of Supervising Inspectors of Steam Vessels, Navy Department, Washington, D. C.,** and is required by them on all boilers under their control.



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PORTABLE BOILERS.

These boilers are of the well-known Locomotive type, with open bottom and mud ring, and are made of open-hearth homogeneous steel plate, and in the best manner throughout, with double-riveted longitudinal seams and large furnace with ample grate surface.

The bottom ring of the furnace is made of a two by three inch wrought-iron bar, giving a three-inch water space on all sides of the fire, and all parts of the boiler are strongly stayed and braced.

The Regular Fixtures comprise: Grates; Steam-Gauge; Water-Gauge; Gauge-Cocks; Safety-Valve; and Blow-off Cock.

SPECIFICATIONS OF PORTABLE BOILERS.

Number of Size	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Horse Power, as usually rated	**25**	**30**	**35**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**110**	**125**
Diameter of Boiler...in inches	**40**	**42**	**44**	**44**	**48**	**54**	**56**	**58**	**58**	**62**	**64**	**66**
Length of Furnace inside... "	48	50	50	50	54	60	60	60	60	60	60	60
Width of Furnace inside... "	34	36	38	38	42	48	50	52	52	56	58	60
Height of Furnace above Grates... "	33	34	36	36	40	44	44	48	48	50	52	58
Number of Tubes (3-inch diameter)	34	40	44	44	54	60	66	76	76	90	100	108
Length of Tubes used...in feet	8	8	8½	10	10½	11	12	12	14	14	15	15
Thickness of Shell and outside of Fire Box...in inches	9/32	9/32	9/32	9/32	5/16	5/16	11/32	11/32	11/32	3/8	3/8	3/8
Thickness of Furnace Plate... "	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16
Thickness of Tube Sheets... "	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	7/16
Diameter of Dome... "	22	22	26	26	26	30	30	32	32	32	36	36
Height of Dome... "	24	24	28	28	28	34	34	36	36	40	40	40
Weight of Boiler...about	6,300	6,900	7,600	8,100	9,000	11,000	12,800	14,000	15,000	16,400	17,200	18,100
Weight of Fixtures... "	1,150	1,250	1,500	1,500	1,600	1,850	2,000	2,150	2,400	2,600	2,800	2,900
Weight of Boiler and Fixtures...about	7,450	8,150	9,100	9,600	10,600	12,850	14,800	16,150	17,400	19,000	20,000	21,000
Boiler, with Regular Fixtures	$	$	$	$	$	$	$	$	$	$	$	$

SMOKESTACKS FOR ABOVE BOILERS FURNISHED, WHEN SO ORDERED, AT THE ADDITIONAL PRICE.

Diameter of Stack...in inches	18	20	20	20	22	24	26	26	26	30	30	32
Length of Stack... in feet	24	24	30	36	36	36	40	40	50	50	50	50
Price of Stack	$	$	$	$	$	$	$	$	$	$	$	$

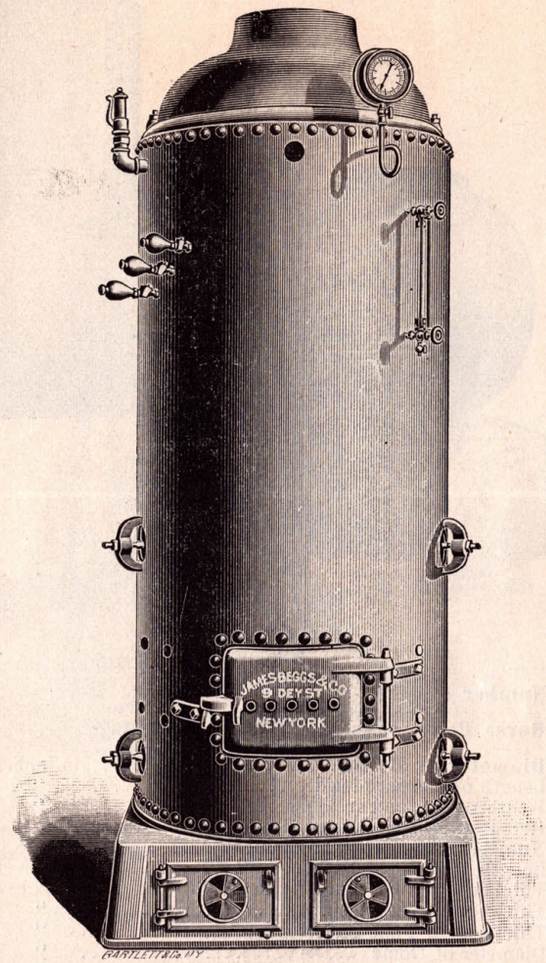
All smokestacks, up to and including 28 inches diameter, are made of No. 16 iron; and larger diameters of No. 14 iron, unless otherwise ordered. If heavier iron is required a proportionate charge will be made.

Pressure: These boilers are designed (unless otherwise specified) to carry a working pressure of 100 pounds of steam to the square inch.

Test: They are subjected to a thorough test by us, before delivery, under a steam pressure of about 120 pounds.

Inspection and Insurance: They are carefully inspected by the Hartford Steam Boiler Inspection and Insurance Company, and tested by (warmed) water pressure to the extent of 150 pounds per square inch without developing any weakness or defects, and insured by them for one year. The certificate of inspection and test, signed by the Company's Inspector; also, Policy of Insurance, will be furnished customers free of charge. This policy is payable to the purchaser, and will be in force and valid wherever the boiler is located.

A Low Water Detector and Alarm is fitted to each boiler. This appliance is reliable, extremely simple, and cannot be tampered with when the boiler is in operation. It is a means of preventing costly damage to boiler when the water becomes dangerously low, by allowing the steam to escape and give alarm; so permanent injury is prevented and the boiler may be left in good condition. This style of DETECTOR has been approved by the United States Board of Supervising Inspectors of Steam Vessels, Navy Department, Washington, D. C., and is required by them on all boilers under their control.



VERTICAL BOILERS,

WITH FULL LENGTH TUBES.

We Build the Best Boiler, of this Type, that is in the Market.

Our Vertical Boilers are made of Homogeneous Open-Hearth Steel Plate throughout, and thoroughly braced; and the longitudinal seams of the shells of Boilers 36 inches and larger in diameter are double riveted.

Boilers 24, 30 and 36 inches in diameter have two, and the larger sizes three hand-holes in the water leg around the fire, and the same number over crown-sheet.

The Regular Fixtures comprise: Base; Grates (having one-half inch opening); Hood; Steam-Gauge; Water-Gauge; Gauge-Cocks; Safety-Valve and Blow-off Cock. The extension shell is furnished with No. 19 and larger sizes, instead of the cast-iron base, and the height of boiler given below, for No. 19 and larger sizes, includes extension of shell.

When these boilers are ordered mounted on wheels, as shown on second page of cover, the tongue is furnished; but the neck-yoke, evener, whiffletrees and brake are subject to order, and are charged extra.

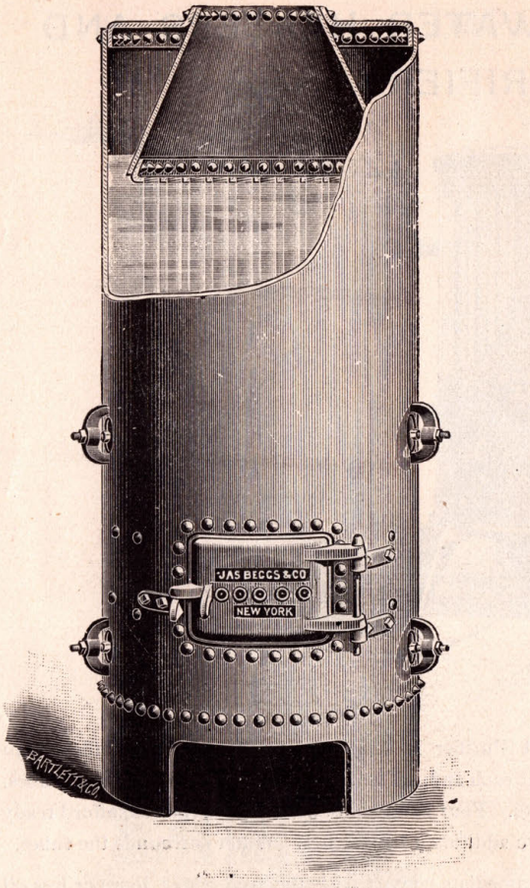
SPECIFICATIONS OF VERTICAL BOILERS.

Number of Size	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Horse-Power, as usually rated	4	5	6	8	10	12	15	18	20	25	30	35	40	45	50	60	70	80	90	90	90	100	100	100	110	110	110	120	120	120	140
Diameter of Boiler.....in inches	24	24	24	30	30	30	36	36	36	42	42	42	48	48	48	54	54	54	60	66	72	60	66	72	60	66	72	60	66	72	72
Height of Boiler.....in feet	4	5	6	5	6	7	6½	7	8	7¼	8¼	9¼	8½	9	10	9	10	11	12¼	11¼	11	13¼	12¼	11½	14¼	13 1/2	12⅛	15¼	13 11/12	12 5/8	14
Diameter of Furnace.....in inches	20	20	20	25	25	25	31	31	31	37	37	37	43	43	43	48	48	48	54	60	66	54	60	66	54	60	66	54	60	66	66
Height of Furnace ..... "	24	24	24	27	27	27	27	27	27	27	27	27	30	30	30	30	30	30	30	36	42	30	36	42	30	36	42	30	36	42	42
Thickness of Shell..... "	¼	¼	¼	¼	¼	¼	¼	¼	¼	9/32	9/32	9/32	5/16	5/16	5/16	5/16	5/16	5/16	5/16	11/32	3/8	5/16	11/32	3/8	5/16	11/32	3/8	5/16	11/32	3/8	3/8
Thickness of Heads..... "	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	7/16	7/16	3/8	7/16	7/16	3/8	7/16	7/16	3/8	7/16	7/16	7/16
Thickness of Furnace Plate. "	No.2	No.2	No.2	No.2	No.2	No.2	No.2	No.2	No.2	No.2	No.2	No.2	No.2	No.2	No.2	No.2	No.2	No.2	No.2	7/16	7/16	No.2	7/16	7/16	No.2	7/16	7/16	No.2	7/16	7/16	7/16
Length of Tubes used.....	24	36	48	33	45	57	51	57	69	60	72	84	72	78	90	78	90	102	102	84	72	114	96	78	126	106	86	138	116	94	108
Number of Tubes (all 2-in. diam.)....	31	31	31	55	55	55	77	77	77	109	109	109	149	149	149	201	201	201	250	300	350	250	300	350	250	300	350	250	300	350	350
Square Feet Heating Surface about	44	60	75	92	121	150	189	210	250	307	364	422	496	535	613	716	820	925	1,080	1,080	1,080	1,200	1,200	1,200	1,320	1,320	1,320	1,440	1,440	1,440	1,700
Weight of Boiler without Fixt's, about	900	1,000	1,150	1,150	1,500	1,700	2,100	2,300	2,600	3,000	3,400	3,800	4,400	4,600	5,000	5,600	6,200	6,800	9,800	11,000	12,000	10,300	11,600	12,400	10,800	12,200	13,000	11,300	12,800	13,300	15,500
Weight of Boiler Fixtures..... "	400	400	400	550	550	550	850	850	850	1,200	1,200	1,200	1,700	1,700	1,700	2,300	2,300	2,300	2,400	2,500	3,000	2,400	2,500	3,000	2,400	2,500	3,000	2,400	2,500	3,000	3,000
Weight of Boiler, complete.....about	1,300	1,400	1,550	1,700	2,050	2,250	2,950	3,150	3,450	4,200	4,600	5,000	6,100	6,300	6,700	7,900	8,500	9,100	12,200	13,500	15,000	12,700	14,100	15,400	13,200	14,700	16,000	13,700	15,300	16,300	18,500
Boiler, with Regular Fixtures....	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$
Price of Injector, fitted to Boiler..	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$
Price of Smokestack.....per foot	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$

Pressure: These boilers are designed (unless otherwise specified) to carry a working pressure of 100 pounds of steam to the square inch.

Test: They are subjected to a thorough test by us, before delivery, under a steam pressure of about 120 pounds.

Inspection: They are carefully inspected by the Hartford Steam Boiler Inspection and Insurance Company, and tested by (warmed) water pressure to the extent of 150 pounds per square inch without developing any weakness or defects. The certificate of inspection and test, signed by the Company's Inspector, will be furnished customers free of charge.



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Our Vertical Boilers are made of Homogeneous Open-Hearth Steel Plate throughout, and thoroughly braced; and the longitudinal seams of the Shells of Boilers 36 inches and larger in diameter are double-riveted.

Boilers 24, 30 and 36 inches in diameter have two, and the larger sizes three hand-holes in the water leg around the fire, and the same number over the crown-sheet.

The Regular Fixtures comprise: Base; Grates; Steam-Gauge; Water-Gauge; Gauge-Cocks; Safety-Valve and Blow-off Cock.

Hoods *are not* required with this style of Boiler.

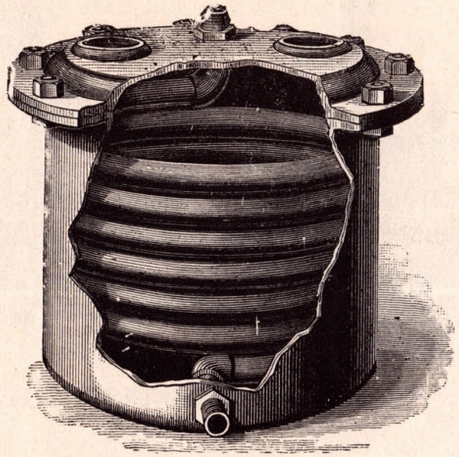
Extension Shell is not furnished with Boiler unless specified in order. If ordered, price will be same as cast-iron base.

SPECIFICATIONS OF VERTICAL BOILERS.

Number of Size	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Horse-Power, as usually rated	**4**	**5**	**6**	**8**	**10**	**12**	**15**	**18**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**60**
Diameter of Boiler...in inches	**24**	**24**	**24**	**30**	**30**	**36**	**36**	**36**	**42**	**42**	**42**	**48**	**48**	**48**	**54**	**54**
Height of Boiler (shell not extended)...in feet	5½	6	6½	6	6½	6½	7	8	7½	8	9	9	9½	10	9½	10½
Diameter of Furnace...in inches	20	20	20	25	25	31	31	31	37	37	37	43	43	43	48	48
Height of Furnace... "	24	24	24	27	27	27	27	27	27	27	27	30	30	30	30	30
Height of Chamber... "	18	18	18	18	18	18	18	18	24	24	24	27	27	27	30	30
Thickness of Shell... "	¼	¼	¼	¼	¼	¼	¼	¼	9/32	9/32	9/32	5/16	5/16	5/16	5/16	5/16
Thickness of Heads... "	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
Thickness of Furnace and Chamber Plates... "	No. 2	No. 2	No. 2	No. 2	No. 2	No. 2	No. 2	No. 2	No. 2	No. 2	No. 2	No. 2	No. 2	No. 2	No. 2	No. 2
Length of Tubes used... "	24	30	36	27	33	33	39	51	39	45	57	51	57	63	54	66
Number of Tubes (all 2-inch diameter)... "	31	31	31	55	55	77	77	77	109	109	109	149	149	149	201	201
Square Feet Heating Surface... ...about	44	52	60	83	98	133	155	196	215	244	301	370	409	448	518	623
Weight of Boiler without Fixtures ...about	1,050	1,100	1,200	1,550	1,700	2,100	2,250	2,500	2,900	3,100	3,400	4,300	4,550	4,750	5,500	6,100
Weight of Boiler Fixtures... "	400	400	400	550	550	850	850	850	1,200	1,200	1,200	1,700	1,700	1,700	2,300	2,300
Weight of Boiler, complete... ...about	1,450	1,500	1,600	2,100	2,250	2,950	3,100	3,350	4,100	4,300	4,600	6,000	6,250	6,450	7,800	8,400
Boiler, with Regular Fixtures...	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$

A Low Water Detector and Alarm is fitted to each Boiler. This appliance is reliable, extremely simple, and cannot be tampered with when the Boiler is in operation. It is a means of preventing costly damage to Boiler when the water becomes dangerously low, by allowing the steam to escape and give alarm; so permanent injury is prevented and the boiler may be left in good condition. This style of DETECTOR has been approved by the United States Board of Supervising Inspectors of Steam Vessels, Navy Department, Washington, D. C., and is required by them on all Boilers under their control.

FEED-WATER HEATERS, CAST-IRON, WITH WROUGHT-IRON COIL.



As shown in cut, these are constructed of a cast-iron case having connections on the cover into which the exhaust pipe from an engine or pump is to be run, for the purpose of heating the feed-water while on its way through the inclosed coil to the boiler. Water of condensation collecting in the bottom of the cast cylinder can be drawn through the tapped opening made for this purpose.

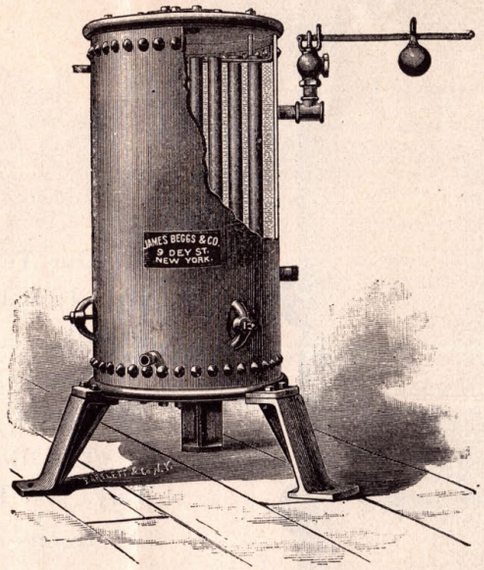
The accompanying table shows the size of connections for both the exhaust steam and the water connection to the coil, and the numbers also shown correspond with these sizes.

As large an amount of pipe as can be conveniently got into the coil is used, so that water returning to the boiler will be heated to a satisfactory temperature.

The numbers cast on the covers correspond with those in the table.

Number	**1**	**2**	**3**	**4**	**5**
Size of Pipe	¾	1	1¼	1½	2
Diameter of Cylinder ..... inches	12¼	14¼	16¾	20¼	24
Height of Cylinder	12	14	16½	20	24
Feet of Pipe in Coil	15	17	24	35	46
Price	$20	$30	$45	$80	$130

TUBULAR FEED-WATER HEATERS AND PURIFIERS.



Our Tubular Feed-Water Heater and Purifier is simple in construction and efficient in operation. A steam chamber is provided at each end. The heads are connected by 2-inch tubes, and the covers are held in place by stud bolts. Four hand-holes, conveniently placed, afford ready access for cleaning. Nos. 9 and 10 have two additional hand-holes. Water surrounds the tubes.

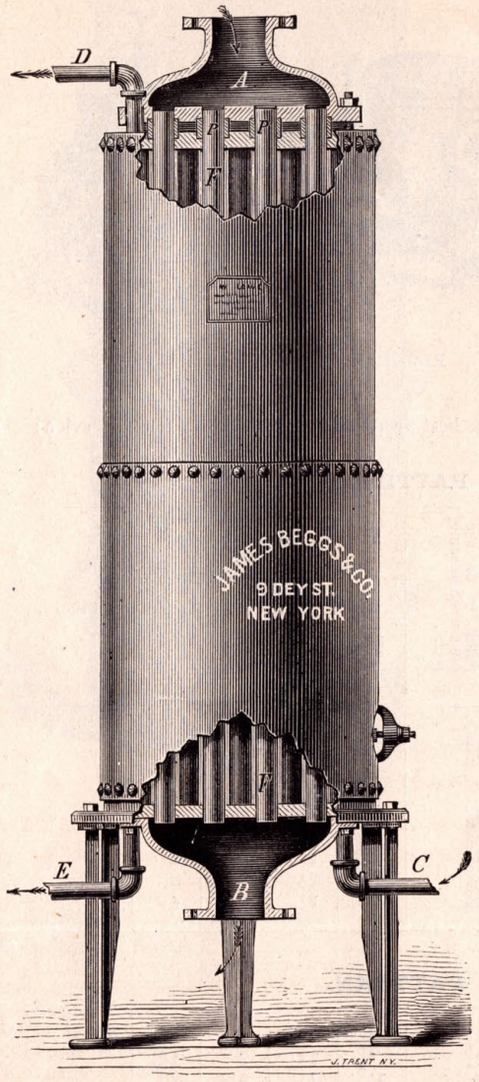
Where exhaust steam is brought into immediate contact with the feed-water, more or less oil from the cylinder of the engine is constantly passing into the boiler with the feed-water and in time coats the inner surface of the boiler and causes the plates to warp and crack.

When so ordered, we make these Heaters with brass tubes at an additional price.

SPECIFICATIONS OF TUBULAR HEATERS.

Number of Size	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Horse-Power, as usually rated	**25**	**30**	**40**	**50**	**65**	**100**	**140**	**200**	**260**	**350**
Diameter of Heater ..... in inches	**20**	**20**	**20**	**24**	**24**	**30**	**30**	**36**	**42**	**42**
Length over all ..... "	42	42	48	48	52	58	68	78	84	84
Number of Tubes, all 2-in. diameter	15	20	20	27	32	46	52	66	80	100
Length of Tubes used ..... in inches	30	30	36	36	36	42	48	54	60	60
Thickness of Shell ..... "	7/32	7/32	7/32	7/32	7/32	¼	¼	¼	9/32	9/32
Thickness of Heads ..... "	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
Diameter of Exhaust ..... "	3	3½	4	4½	4½	6	7	10	10	10
Diameter of Feed-Pipe ..... "	1	1¼	1¼	1¼	1¼	1½	2	2	2½	2½
Size of Safety-Valve ..... "	1¼	1¼	1¼	1¼	1¼	1½	2	2	2	2½
Weight, in pounds ..... about	900	1000	1100	1300	1400	1700	1900	2800	3400	3600
Regular Iron Tube Heater, with Safety Valve	$	$	$	$	$	$	$	$	$	$
Brass Tube Heater (Tubes No. 14, Stubs' Gauge), with Safety Valve	$	$	$	$	$	$	$	$	$	$

IMPROVED FEED-WATER HEATER AND PURIFIER.



In this Heater the feed-water for steam boilers is heated and purified by the exhaust steam from a steam engine (or other source) without bringing the steam into contact with the water, which is the only way that feed-water (free from grease, and the impurities of the water combined with it) can be obtained, and these deleterious matters prevented from going into the boiler and fouling it, causing pitting, corroding and burning of the plates.

This is the most economical way in which pure hot water can be obtained for manufacturing purposes in mills and factories, and purified hot or cold water for breweries, hotels, hospitals, homes and institutions of all kinds needing pure water.

These Heaters and Purifiers are used in connection with all regular steam engines, also compound condensing and triple expansion engines, where they produce the best economy of fuel.

Each tube is allowed free expansion and contraction independent of the shell, heads or other tubes. Both ends of the tubes are easily accessible, and the entire number can be removed and a new set inserted, should occasion require, without removing the Heater from its legs or breaking any pipe connections, except the connections of exhaust with nozzles. Hand-holes furnish a ready means for cleaning and washing out.

These Heaters are made for either vertical or horizontal positions, but the vertical position is the most efficient, for the reason that the steam enters at the top and passing down through the tubes is compressed so as to fill the entire space—very much better than when steam is introduced at the bottom. The water of condensation falls to the bottom, where it is easily drawn off. This produces a very much better result, and more steam is condensed, than where the water of condensation is blown up through the tubes with the escaping steam. As a natural result the feed-water is taken through the pipe **D** at a temperature of 206 to 212 degrees, the top being the hottest part of the Heater. The hot water rises to the top, and the hot steam entering at that point furnishes hot water to feed the boiler almost immediately after starting the engine. The water from pump enters the Heater through the pipe **C** and consequently travels as it rises in a diagonal course to opposite side, where it leaves through the pipe **D**. Thus it will be seen we get a better circulation of water among the tubes than could otherwise be secured.

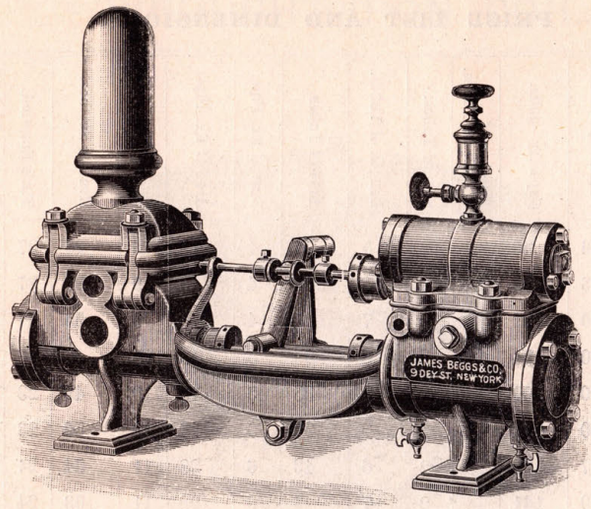
This Heater will, therefore, purify the water, and will precipitate more scale-producing substances than could be attained with any other arrangement. The sediment which falls to the bottom in the form of mud is blown off through the pipe **E** with waters containing magnesia and other substances which float; a surface blow-off is attached to the shell near the top through which the scum may be blown off.

PRICE LIST AND DIMENSIONS.

Number.	Size.	Horse-Power, at 4 galls. per hour.	Capacity—galls.	Number of Brass Tubes.	Size of Tubes.	Length of Tubes.	Area of Tubes.	Size of Ex. Pipe.	Area of Ex. Pipe.	Diam. of Flanges.	Heating Surface.	Time Emptied.	Shipping Weight, Skidded, and Legs Packed in Box.	Price.
A 1.....	18x 5	36	66	10	2	5	24	4½	15	9	25	27	850	$.....
B 1.....	18x 6	43	79	10	2	6	24	4½	15	9	30	27	980	.....
C 1.....	18x 7	50	92	10	2	7	24	4½	15	9	35	27	1,065	.....
A 2.....	21x 6	60	94	14	2	6	35	5	19	10	42	23	1,250	.....
B 2.....	21x 7	70	109	14	2	7	35	5	19	10	49	23	1,300	.....
C 2....	21x 8	80	124	14	2	8	35	5	19	10	56	23	1,450	.....
A 3.....	24x 6	77	123	18	2	6	43	6	28	11	54	24	1,550	.....
B 3.....	24x 7	90	141	18	2	7	43	6	28	11	63	24	1,650	.....
C 3.....	24x 8	103	159	18	2	8	43	6	28	11	72	24	1,800	.....
A 4.....	27x 6	103	154	24	2	6	57	7	38	12	72	22	2,000	.....
B 4.....	27x 7	120	179	24	2	7	57	7	38	12	84	22	2,050	.....
C 4. ...	27x 8	137	204	24	2	8	57	7	38	12	96	22	2,250	.....
D 4.....	27x 9	154	229	24	2	9	57	7	38	12	103	22	2,300	.....
A 5.....	30x 7	150	222	30	2	7	72	8	50	13	105	22	2,550	.....
B 5.....	30x 8	171	254	30	2	8	72	8	50	13	120	22	2,600	.....
C 5.....	30x 9	190	286	30	2	9	72	8	50	13	135	22	2,950	.....
D 5.....	30x10	214	318	30	2	10	72	8	50	13	150	22	3,150	.....
A 6.....	36x 8	217	379	38	2	8	91	10	78	15	152	26	3,600	.....
B 6.....	36x 9	244	426	38	2	9	91	10	78	15	171	26	3,960	.....
C 6.....	36x10	270	473	38	2	10	91	10	78	15	190	26	4,400	.....
D 6....	36x11	298	520	38	2	11	91	10	78	15	209	26	4 500	.....
A 7.....	42x 9	295	580	46	2	9	110	10	78	15½	207	29	....	.....
B 7.....	42x10	328	644	46	2	10	110	10	78	15½	230	29	5,800	.....
C 7.....	42x11	360	708	46	2	11	110	10	78	15½	253	29	....	.....
D 7.....	42x12	394	772	46	2	12	110	10	78	15½	270	29	6,450	.....
A 8.....	48x 9	386	757	60	2	9	114	12	113	18	270	29	....	.....
B 8.....	48x10	420	841	60	2	10	114	12	113	18	300	29	7,100	.....
C 8.....	48x11	472	925	60	2	11	114	12	113	18	330	29	....	.....
D 8.....	48x12	514	1009	60	2	12	114	12	113	18	360	29	....	.....
F 8.....	48x14	600	....	..	..	..	...	..	...	..	...	..	9,000	.....

All Feed-Water Heaters and Purifiers have two-inch Seamless Brass Tubes, two pounds per foot.

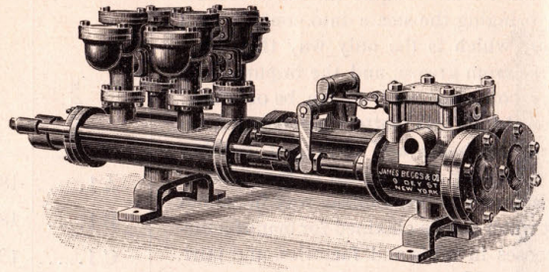
SINGLE CYLINDER STEAM PUMP.



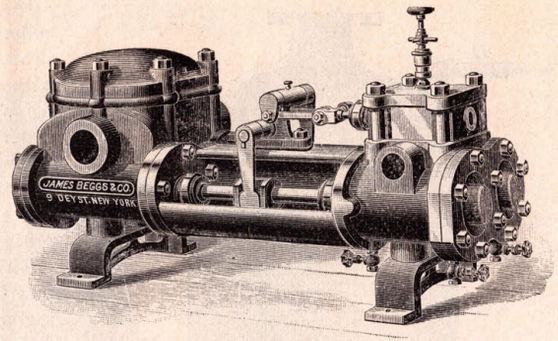
PUMP No. 3. 5¼×3½×6.

Number.	Diameter of Steam Cylinder in Inches.	Diameter Water Cylinder in Inches.	Length of Stroke in Inches.	Strokes per minute for heavy pressures and continuous work.	Capacity, in gallons, at this speed.	Size of Steam Pipe.	Size of Exhaust Pipe.	Size of Suction Pipe.	Size of Discharge Pipe.	Prices.
0	3	1¾	4	100 Str.	4	½	¾	1	¾	$50
1	3½	2	4	100 "	5	½	¾	1	¾	65
1½	3½	2¼	5	90 "	8	½	¾	1¼	1	95
2	4	2½	5	90 "	10	½	¾	1¼	1	105
3	5¼	3½	6	85 "	21	¾	1	2	1½	145
4	5¾	3¾	8	80 "	30	¾	1	2½	2	175
4½	6	4	8	80 "	34	¾	1	2½	2	200
5	7	4½	10	75 "	51	1	1½	3	2½	275
7	10	6	12	60 "	87	1½	2	4	3	400
9	14	8	12	60 "	150	2	2½	5	3½	550

DUPLEX BOILER FEED STEAM PUMP.



PRESSURE PATTERN. Size, 6×3½×6.



REGULAR PATTERN. Size, 6×4×6.

The following sizes are selected as being those best proportioned for this particular service:

REGULAR PATTERN.

Diameter of Steam Cylinders.	Diameter of Water Plungers.	Length of Stroke.	Horse Power of Boiler, based on 30 pounds of water per hour, which the pump will supply with ease.	Diameter of Plunger required in any single cylinder pump to do the same work at same speed.	Sizes of Pipes for Short Lengths. To be increased as length increases.				Prices.
					Steam Pipe.	Exhaust Pipe.	Suction Pipe.	Discharge Pipe.	
2	1⅛	2¾	35	1⅝	⅜	½	1	¾	$
3	1¾	3	60	2⅞	⅜	½	1¼	1	
4½	2¾	4	150	4	½	¾	2	1½	
5¼	3½	5	300	5	¾	1¼	2½	1½	
6	4	6	400	5⅝	1	1½	3	2	
7½	4½	6	500	6⅜	1½	2	4	3	
7½	4½	10	700	6⅜	1½	2	4	3	
9	5¼	10	900	7½	2	2½	4	3	
10	6	10	1,200	8½	2	2½	5	4	

PRESSURE PATTERN.

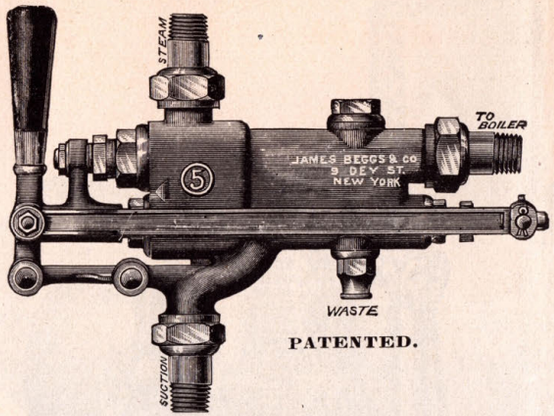
4½	2	4	125	3¼	½	¾	1½	1¼	$
5¼	3	5	225	4¼	¾	1¼	2	1½	
6	3½	6	300	5	1	1½	2½	2	
7½	4	6	400	5⅝	1½	2	3	2½	
7½	4¼	10	600	6	1½	2	4	3	
10	5	10	1,000	7¾	2	2½	4	3	

A slight additional charge is made when pumps are fitted with Brass Plungers and Piston Rods.

To designate the sizes, give the diameters of Steam Cylinders and Water Plungers, and length of stroke.

☞ In addition to the sizes given in the above list, a large number of other sizes and combinations can be supplied to meet the requirements of any particular service.

As Boiler feeding is usually heavy CONTINUOUS work, we recommend a size LARGE enough to keep up the supply of water in the Boiler when the Pump is run slowly. This avoids the concussion and jar of the pipes and connections which is always noticeable when Pumps are run fast on this work. For feeding HOT WATER, set the Pump BELOW the supply, so the water will FLOW into it, as HOT WATER cannot be lifted by suction. Allow 7½ gallons per hour for each horse-power.



PATENTED.

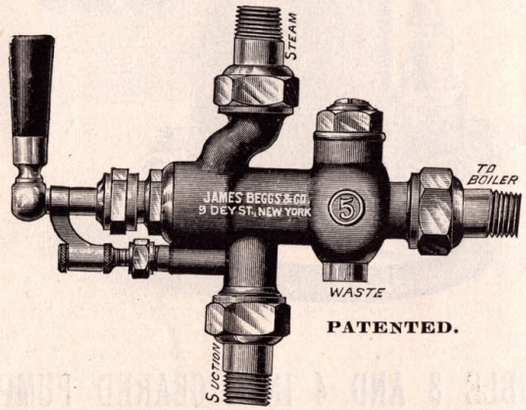
Double Tube. Operated entirely by One Lever.

HIGH DUTY INJECTOR.

A higher degree of efficiency secured than ever before. Will lift either hot or cold water, and is guaranteed to work satisfactorily under all pressures from 20 to 200 pounds and to lift from 10 to 24 feet, or take supply direct from tanks or water-works pressure.

PRICE LIST.

Size.	Size Connections.		Gallons per Hour.	Horse Power.	Price.
	Suction and Delivery.	Steam.			
3½	⅜	⅜	85	4 to 8	$22 00
5	½	½	130	8 to 12	25 00
5½	½	½	180	12 to 25	28 00
7	¾	½	250	20 to 35	35 00
9	¾	¾	350	30 to 45	40 00
9½	1	¾	450	40 to 60	50 00
11	1	1	575	60 to 80	55 00
13	1¼	1	725	75 to 100	60 00
13½	1¼	1¼	900	90 to 125	65 00
15	1½	1¼	1,260	120 to 175	85 00
15½	1½	1½	1,700	150 to 235	100 00
17	2	1½	2,200	200 to 300	120 00
17½	2	1½	2,800	250 to 360	135 00



PATENTED.

Operated entirely by One Handle.
No Valves required in either Steam or Suction Pipe.
Perfectly Automatic and Re-starting.

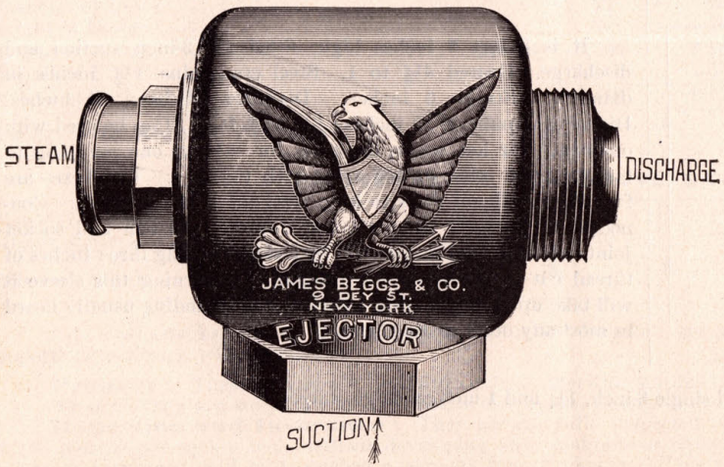
AUTOMATIC INJECTOR.

Particularly Adapted for Use on Traction, Portable and Marine Boilers.

The capacity of this machine can be graded over fifty per cent., thus supplying the boiler with the exact quantity of water required to run the Injector continuously. It works equally well whether lifting water or taking supply from overhead tanks or city pressure, and does not require valves to regulate the machine, in either the steam or supply pipe, when in use under either condition—points that are not attained in any other machine made.

PRICE LIST OF AUTOMATIC INJECTOR.

Size.	Size Connections.		Gallons per Hour.	Horse Power.	Price.
	Suction and Delivery.	Steam.			
2	¼	¼	40	2 to 4	$16 00
4	⅜	⅜	90	4 to 8	18 00
5	½	½	130	8 to 12	20 00
7	¾	½	220	12 to 20	25 00
9	¾	¾	330	20 to 30	30 00
9½	1	¾	430	30 to 45	40 00
11	1	1	550	45 to 60	45 00
13	1¼	1	720	60 to 85	55 00
15	1¼	1¼	920	85 to 120	60 00
17	1½	1¼	1,260	120 to 165	75 00
19	1½	1¼	1,740	165 to 230	90 00
21	2	1½	2,200	200 to 300	110 00
23	2	1½	2,800	275 to 375	125 00



No Valves to Wear. No Liability of Getting Out of Order.
A Complete Steam Pump at a Small Cost.

EJECTOR OR JETOMETER.

For Pumping Water or Other Liquids. Is Operated with Less Steam Than Any Other Ejector Made.

It is adapted for raising water from deep wells; for pumping out the holds of vessels; for use in tanneries in conveying liquids; for pumping out mines, cellars or cesspools; for filling tanks at railroad stations or pumping direct into the tenders of locomotives. Can be arranged to lift water to any height desired. It is the best bilge pump made. It is made so that parts liable to wear can be replaced, when required, at small expense.

PRICE LIST.

No.	Size of Suction and Discharge Pipe.	Size of Steam Pipe.	Capacity per Hour.	Price.
2	½ inch.	¼ inch.	250 gals.	$8 00
4	¾ "	⅜ "	500 "	10 00
6	1 "	½ "	1,000 "	15 00
8	1¼ "	¾ "	1,600 "	20 00
10	1½ "	1 "	2,400 "	25 00
12	2 "	1 "	3,600 "	35 00
14	2½ "	1¼ "	6,000 "	45 00
16	3 "	1½ "	10,000 "	60 00
18	4 "	2 "	15,000 "	80 00

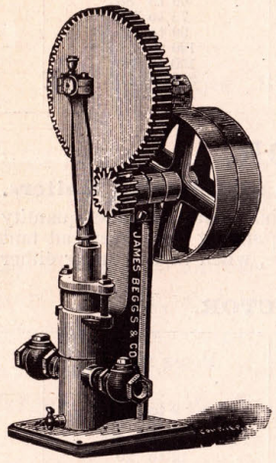
Ejectors of larger capacity or for special purposes made to order.

WATER PRESSURE EJECTORS.

We also make Ejectors that can be worked by water pressure. These Ejectors will eject double the quantity of water that it takes to run them, and they can be used to advantage in excavations, cellars, etc., where water pressure can be had and the elevation required is not too high for the pressure obtained.

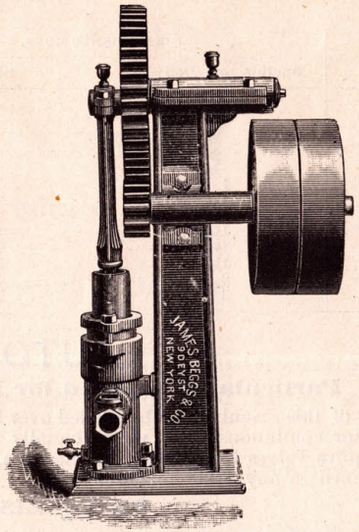
DIMENSIONS AND PRICES.

No.	20	22	24
Capacity, gallons per hour	375	600	1,275
Size of Water-Pressure Pipe	½ inch.	¾ inch.	1 inch.
Size of Delivery Pipe	1 "	1¼ "	2 "
Price	$18 00	$28 00	$38 00



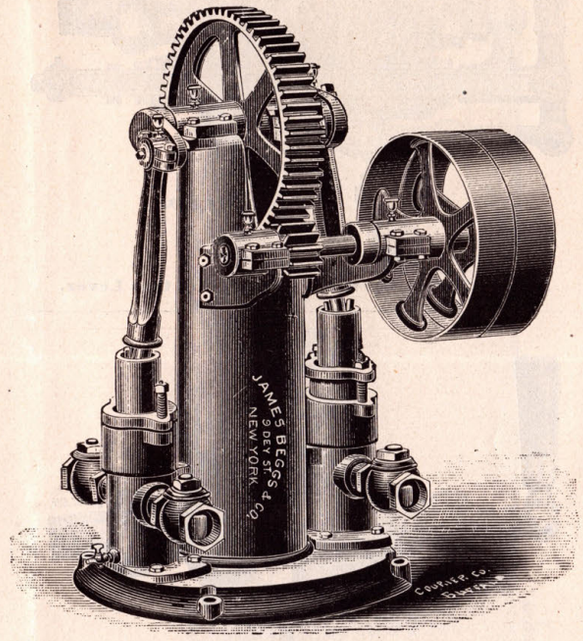
SINGLE 2-INCH BOILER FEED PUMP.

Geared 4½ to 1; 12-inch pulleys; 2-inch face. All our pumps are connected with ball and socket in plungers.



SINGLE 3-INCH BOILER FEED PUMP.

This is the strongest pump in the market, built for heavy work and positive action. Geared 3 to 1; 1½-inch steel crank-pin; about 3 feet 4 inches high, base 11 x 15 inches; pulleys 14 inches in diameter, 3½-inch face; bearing on large gear shaft 10 inches long, 1½ inches in diameter; bearing on pinion shaft 8½ inches long, 1½ inches in diameter; ball and socket joint; adjustable at upper end of plunger. The steel ball at bottom end of connecting rod is submerged in oil contained in the hollow plunger.



DOUBLE 3 AND 4 INCH GEARED PUMP.

For Hot or Cold Water.

It is 3 feet 6 inches high, fitted for 2-inch suction and discharge. Geared 4½ to 1. Steel crank-pins 1½ inches in diameter. Stroke 6 inches. Diameter of base, 23 inches. Diameter of pulleys, 18 inches; 3½-inch face. Can be used with one pump for hot water, the other for cold, or one pumping to tank and the other to boiler, or both together. The boxes are furnished with oil cups to keep dust out of the journals. Connected to plungers by novel and durable steel ball and socket joint, which is held in position by a sleeve having three inches of thread cut in upper part of plunger. By turning this sleeve it will take up all lost motion, avoiding the pounding usually heard in most any other make of pump.

Number.	Diameter and Length of Stroke.	Number of Strokes Per Minute.	Capacity Per Hour.	Prices.
2, Single	2x4	40	130	$42 00
3, "	3x6	40	420	66 00
3, Double	3x6	40	840	185 00
4, "	4x6	40	1,860	.....
3, Gang	3x6	40	1,680	.....
4, "	4x6	40	3,600	.....

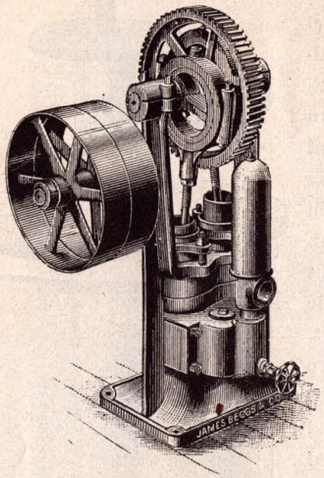
These speeds can be changed from 20 to 50 revolutions per minute to get required quantity of water.

The ordinary sizes of check valves used are: 2-inch on double 4-inch, 1½-inch on double 3-inch and single 3-inch, 1¼ and 1 inch on single 3-inch.

All Parts Duplicated and can be Purchased at a Moderate Cost.

Double Plunger Belt Pump.

The most economical means for supplying Water to Boilers, Tanks, etc.



It has a Passover Valve to regulate the supply of water without changing the speed of the pump. Suitable for either hot or cold water, and is furnished complete with gears, fast and loose pulleys, and valves ready to connect.

Price List of Double Pumps, Geared 4½ to 1.

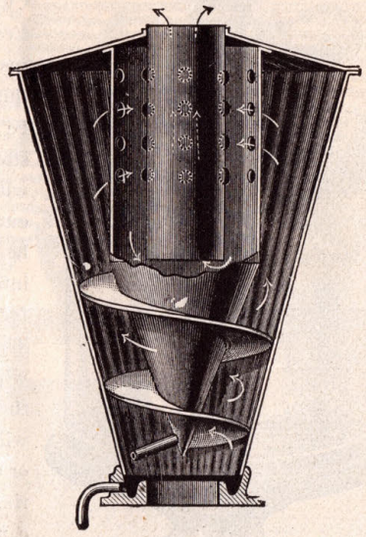
No.	Plunger.	Stroke.	Suction and Discharge.	Size of Pulleys.	Gals. per Double Stroke.	Strokes per Minute.
2	3	4	1½	14x3	0.244	10 to 40
3	4	6	2	20x4	0.652	10 to 30
4	6	6	2½	28x5	1.478	10 to 30

No.	Medium Speed.	Gals. per Hour at Moderate Speed.	Price.	Price with Cut Gears.
2	30	440	$137 00	$150 00
3	20	780	192 00	212 00
4	20	1,760	300 00	330 00

Patent Centrifugal Exhaust Head.

For Exhaust Steam Pipes.

Thoroughly entraps Water and Grease from the Exhaust Steam, Without Back Pressure.



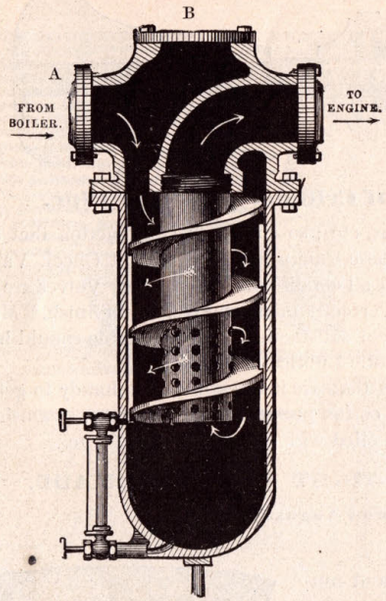
Saves Roofs by keeping them dry, utilizes the water of Exhaust Steam and avoids spraying the pavement. Should be used by all Rolling Mills, Blast Furnaces, Breweries and Manufactories using steam.

List of Prices and Sizes of Exhaust Pipe Heads.

Size for	1	inch Iron Pipe	$18 00
"	1½	" "	22 00
"	2	" "	25 00
"	2½	" "	28 00
"	3	" "	30 00
"	3½	" "	35 00
"	4	" "	40 00
"	4½	" "	45 00
"	5	" "	50 00
"	6	" "	60 00
"	7	" "	70 00
"	8	" "	85 00
"	9	" "	110 00
"	10	" "	120 00
"	12	" "	150 00
"	14	" "	180 00
"	16	" "	220 00

Centrifugal Separator and Trap.

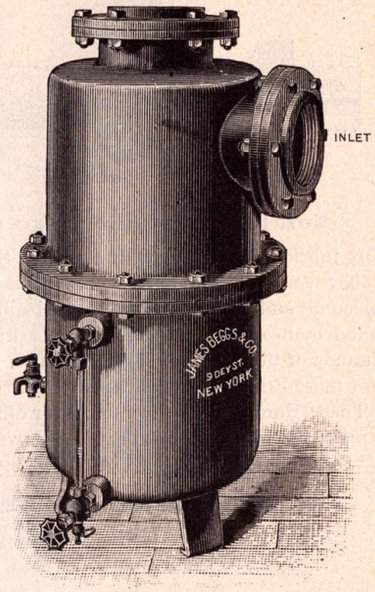
For Supplying Clean and Dry Steam to Engines, Dry Houses, etc.



Place Separator as close to engine as possible. The steam taking a spiral course between the threads causes the water to be thrown by centrifugal force against the outer walls, while the dry steam goes through the small holes to center of pipe. Steam can enter at A or B as convenience may require, also used in conveying steam long distance for Steam Hammers, and Dry Houses.

Size of Steam Pipe.			Price.
1	inch	Screwed,	$25 00
1½	"	"	37 50
2	"	Flanged,	50 00
2½	"	"	62 50
3	"	"	75 00
3½	"	"	87 50
4	"	"	100 00
4½	"	"	112 50
5	"	"	125 00
6	"	"	150 00
7	"	"	175 00
8	"	"	200 00
9	"	"	250 00
10	"	"	300 00

Centrifugal Oil Extractor.

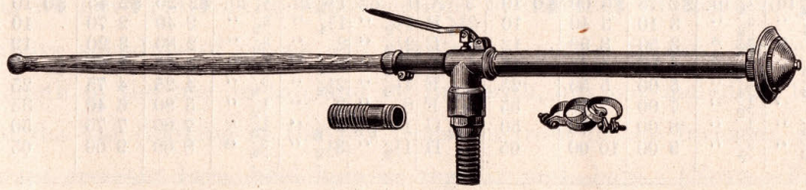


PRICE LIST.

Size of Exhaust Pipe.			Price.
1	inch	Screwed,	$25 00
1½	"	"	37 50
2	"	Flanged,	50 00
2½	"	"	62 50
3	"	"	75 00
3½	"	"	87 50
4	"	"	100 00
4½	"	"	112 50
5	"	"	125 00
6	"	"	150 00
7	"	"	175 00
8	"	"	200 00
9	"	"	250 00
10	"	"	300 00

Screwing Flanges Included.

STEAM FLUE BLOWER.



CUT SHOWING BLOWER FOR HORIZONTAL BOILERS.

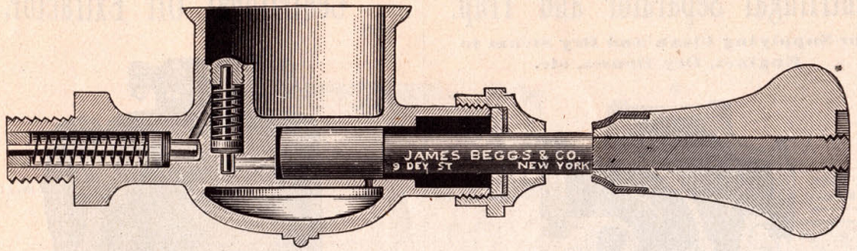
Always Reliable. Simple in Construction. Easy to Operate. Economizes Fuel. Increases Boiler Capacity.

PRICE LIST.

No. of Blower.	Size of Tubes, Outside Diameter.	Price with Clamps and Nipple.
No. 0	1¼ to 1¾	$5 00
No. 1	2 to 2¼	5 00
No. 2	2½ to 2¾	6 25
No. 3	3 to 3¼	7 50
No. 4	3½ to 3¾	8 75
No. 5	4 to 4½	10 00
No. 6	5 to 6	12 50

☞ The above prices do not include Hose and Globe Valves, which we can furnish of very best quality and at lowest market price.

PATENT HAND CYLINDER OIL PUMPS.



Nos. 3, 04, 4 and 5 to go on Side of Cylinder or Steam Pipe.

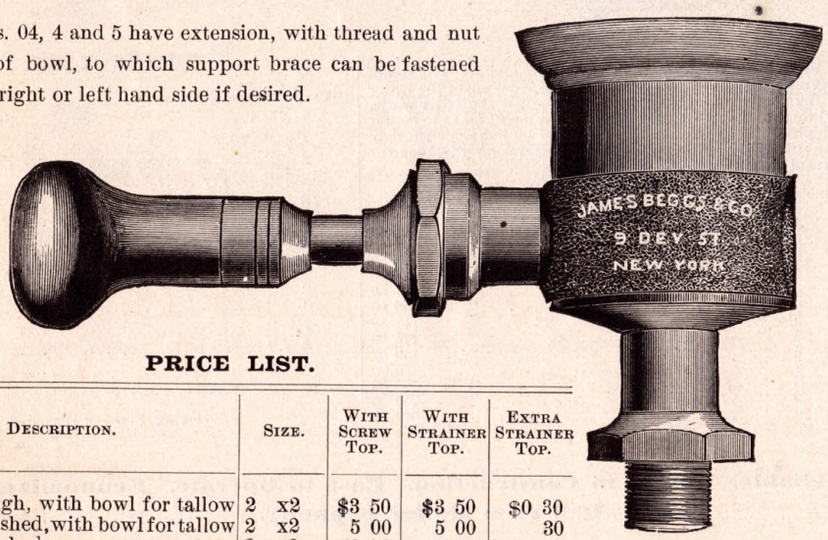
FOR lubricating Cylinders of Engines, Steam Pumps, etc.; so simple in construction that any boy can readily understand how to use them. These Pumps have two patent Check Valves between oil and steam. Guaranteed steam tight under all conditions. Our patent Valves are not affected by heat and cold as all other kinds are. Perfectly made and elegant in finish. Many thousands of these Oil Pumps are in use, giving perfect satisfaction. Every engine should have one of these Pumps, whether provided with an Automatic Lubricator or not.

These Pumps are also valuable for oiling journals that are inaccessible or unhandy to get at, and many are in use on band saw mills, water wheels, cotton presses, steam hammers, steamships, etc. By using a Two-outlet Cock two journals can be oiled with one pump at one time.

THE ONLY ABSOLUTELY STEAM-TIGHT OIL PUMP MADE.

Patented January 22, 1878, and August 8, 1882.

☞Nos. 04, 4 and 5 have extension, with thread and nut on bottom of bowl, to which support brace can be fastened from either right or left hand side if desired.



Nos. 03 and 6 to go on top of Cylinder or Steam Pipe.

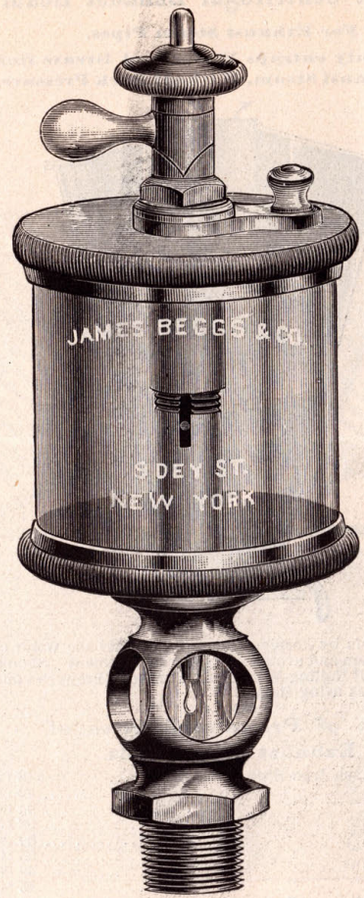
PRICE LIST.

Description.	Size.	With Screw Top.	With Strainer Top.	Extra Strainer Top.
No. 1. Rough, with bowl for tallow	2 x2	$3 50	$3 50	$0 30
No. 2. Finished, with bowl for tallow	2 x2	5 00	5 00	30
No. 03. Finished	2 x2	3 50	3 65	40
No. 6. Finished	2¾x2¾	5 00	5 25	60
No. 3. Finished	2 x2	3 50	3 65	40
No. 04. Finished	2¾x2¾	5 00	5 25	60
No. 4. Finished	3½x3½	7 50	7 80	75
No. 5. Finished	7 x4½	12 00	12 00	....
Loco Pump, Gauge-Glass and 2-outlet Cock	7 x4½	20 00	20 00	....

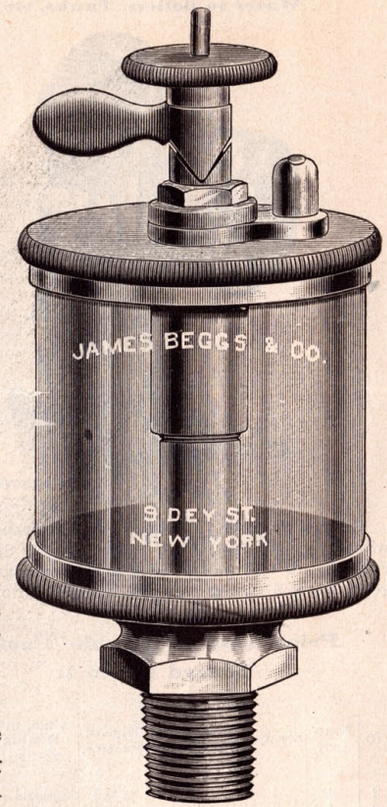
Fifty cents extra will be charged when special M. and F. Valves are sent with Pumps.

GLASS OIL CUPS.

PATENTED.



Figs. 55 and 75 are the Finest Oil Cups ever made. Feed can be adjusted to suit with thumb nut, then can be stopped and started instantly with lever shown in cut, or the cup can be flushed without interfering with the feed adjustment. The feed valve when adjusted for the required feed will not be moved or disturbed by jarring. These cups can be easily and quickly taken apart for the purpose of cleaning, without the use of a wrench. They are made heavy and strong and are finely finished.



PRICE LIST.—Fig. 55.

Size.	Capacity.	Diameter of Glass.	Size of Shank, Thread, Iron Pipe.	Price, Each, Brass Finished.	Price, Each, Nickeled.	Price, Extra, Glasses, Each, Net.
A	1 oz.	1½ in.	¼ in.	$2 75	$3 00	$0 10
B	1½ "	1¾ "	⅜ "	3 10	3 40	10
C	2¼ "	2 "	⅜ "	3 50	3 90	12
D	3½ "	2¼ "	⅜ "	4 00	4 40	15
E	4½ "	2½ "	⅜ "	5 00	5 50	25
F	8 "	3 "	½ "	7 00	7 60	35
G	1 pt.	3½ "	½ "	8 00	8 75	50
H	1½ "	3½ "	¾ "	9 00	10 00	65

PRICE LIST.—Fig. 75.

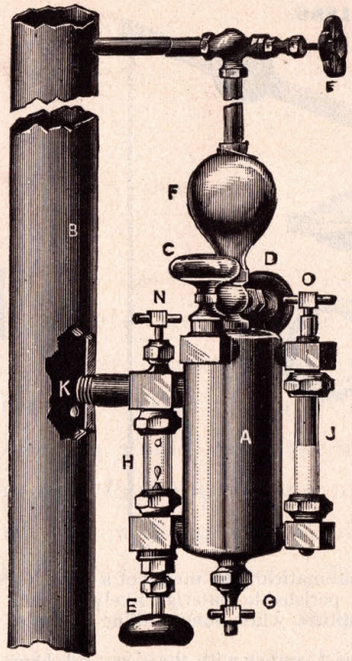
Size.		Capacity.	Diameter of Glass.	Size of Shank, Thread, Iron Pipe.	Price, Each, Brass Finished.	Price, Each, Nickeled.	Price, Extra Glasses, Each, Net.
2	A	1 oz.	1½ in.	¼ in.	$2 20	$2 45	$0 10
2½	B	1½ "	1¾ "	⅜ "	2 40	2 70	10
3	C	2¼ "	2 "	⅜ "	2 80	3 20	12
4	D	3½ "	2¼ "	⅜ "	3 25	3 65	15
5	E	4½ "	2½ "	⅜ "	4 25	4 75	25
6	F	8 "	3 "	½ "	5 80	6 40	35
6½	G	1 pt.	3½ "	½ "	7 00	7 75	50
7	H	1½ "	3½ "	¾ "	8 00	9 00	65

☞Cups are sent regular pipe thread shanks as per above list, unless otherwise specified.

JAMES BEGGS & CO., No. 9 DEY STREET, NEW YORK.

SIGHT-FEED LUBRICATORS

For Steam Engines, Pumps, Etc.



DESCRIPTION.

A—Oil Reservoir.
B—Steam Pipe.
C—Oil Filler.
D—Water-Feed Valve.
E—Valve to regulate flow of Oil.
FF—Steam Tube and condensing chamber.
G—Drain Valve to draw off water to prevent freezing, etc.
H—Sight-Feed Glass.
J—Glass Indicator.
K—Oil Discharge Pipe.
N—Valve to correct Pulsation or Unsteadiness in Feed.
O—Vent.

NOTE.—⅛ Pints have no Gauge Glass.

PRICE LIST.

SIZE.	PLAIN BRASS.	NICKEL PLATED.	SUITABLE FOR ENGINE WITH DIAMETER OF CYLINDER AS FOLLOWS:
One-third Pint	$17 00	$20 00	Up to 8 inches.
Half Pint ...	22 00	25 00	8 to 10 inches.
Pint.....	30 00	35 00	10 to 18 inches.
Quart.....	45 00	50 00	18 to 30 inches.
Half Gallon...	60 00	65 00	30 and over.
Gallon.....	75 00	80 00	.....

OUR OFFER.—To responsible parties we will send a Lubricator on **Twenty Days' Trial.** At the end of that time, if not found satisfactory, it can be held subject to our order.

Write for prices. The above list subject to liberal discount. Over 50,000 of the above Lubricators in actual use.

HOW TO ATTACH LUBRICATORS.

FIRST—Drill and tap the steam-pipe ABOVE the throttle with ¼ or ¾ inch gas tap, as may be required to receive the oil discharge pipe. Then tap the steam-pipe *not less than three feet* (and greater length is desired) above the top of the condensing chamber, as may be required, using ¼-inch gas-pipe for steam connecting tube, which attach to top of condenser. If, for any reason, steam-pipe cannot be tapped "three feet or more above condensing chamber," tap lower down, and the tube of required length may be BENT OR COILED.

HOW TO FILL AND OPERATE THE LUBRICATOR.

Close valves D and E; open valve G, draw off the water, close valve G and fill with oil. FIRST, open valve D, then regulate flow of oil with valve E.

In case of strong pulsation, valve N to be partially closed until oil feeds steadily; same to be closed in case of breaking of feed glass.

Before starting the Cup, time should be allowed for "Sight-feed glass and condensing chamber" to fill with water by condensation.

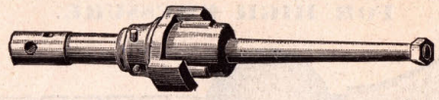
In special cases, when cup cannot be attached as shown in cut, send us a diagram and we will give directions.

When applied and operated according to instructions, we guarantee PERFECT SATISFACTION, as they NEVER FAIL.

TO PREVENT FREEZING.

Valves D, G and E should be left open.

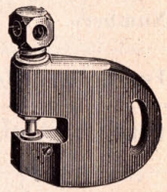
ROLLER TUBE EXPANDER.



Diameter.....	1″	1¼″	1⅜″	1¾″	1⅞″	2″	2¼″	2½″	2¾″	3″
Price.....	$20 00	$20 00	$20 00	$25 00	$25 00	$30 00	$35 00	$42 00	$48 00	$55 00
Diameter.....	3¼″	3⅜″	3¾″	4″	4¼″	4½″	5″	6″	7″	
Price.....	$60 00	$70 00	$75 00	$85 00	$90 00	$100 00	$120 00	$130 00	$180 00	

These dimensions refer to the external DIAMETER of tube.

BOILER MAKERS' STEEL SCREW PUNCHES.

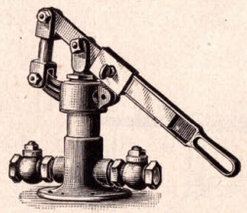


No. 0 punches	½	in. hole in	¼	in. iron,	1½	in. from edge of sheet,	17 lbs.....	$24 00
" 1 "	½	" "	5/16	" "	1½	" " "	27 "	30 00
" 2 "	¾	" "	½	" "	2	" " "	40 "	40 00
" 3 "	¾	" "	¾	" "	2½	" " "	60 "	60 00
" 3½ "	¾	" "	¾	" "	3½	" " "	90 "	75 00
" 4 "	¾	" "	¾	" "	4	" " "	110 "	80 00

ONE PUNCH AND DIE FURNISHED.

Extra punches and dies per pair: No. 0, $3.50; Nos. 1 and 2, $4.00; Nos. 3, 3½ and 4, $5.00.

BOILER MAKERS' TEST or PRESSURE PUMP.

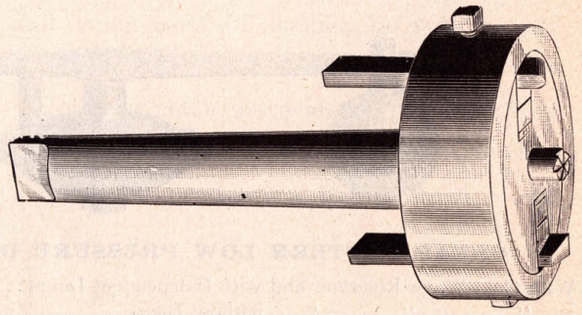


No.	DIAMETER OF CYLINDER.	SUCTION AND DISCHARGE.	STROKE.	PRICE.
1	1 inch	¾ inch	4 inches	$28 00
2	1½ "	1 "	4 "	30 00
3	1¾ "	1¼ "	5 "	38 00
4	2 "	1½ "	6 "	45 00

This pump, as shown in illustration, has a revolving top, admitting its being worked in any position, and a sectional lever which can be changed to give greater leverage. It will generate a cold-water pressure of 500 pounds per square inch. This pump is fitted with brass check valves, and two brass hose couplings are furnished with each pump.

TUBE HOLE CUTTER.

These cutters are of two sizes, one for tubes from two to four inches, inclusive, the other from three to six inches, inclusive. The body and shank of No. 1 are in one piece, made from forged steel. The part that holds the knives being hardened to prevent wear. The body of No. 2 is of best grade of steel casting and of best quality steel. The adjustment for different sizes is made by packing blocks, which are quickly arranged.



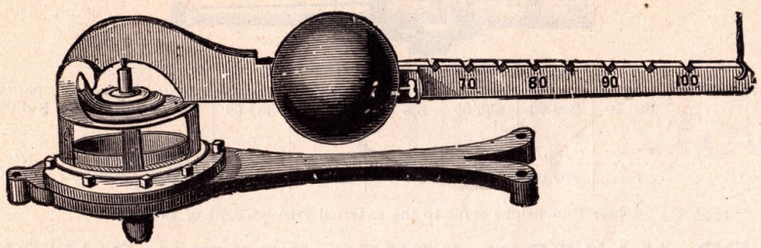
Price of No. 1, $40. No. 2, $45.

Extra Knives, $1 per pair.

The shanks are left straight, of sufficient size to be fitted to the largest Morse taper, unless ordered to be made to a particular size and taper. In ordering shanks to be turned, if for Morse taper, please mention the size or send template of the socket, as it is necessary for the shanks to be a good fit.

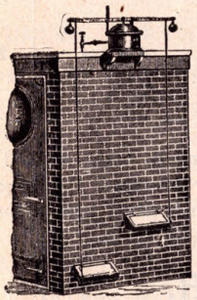
STEAM DAMPERS OR DRAFT REGULATORS.

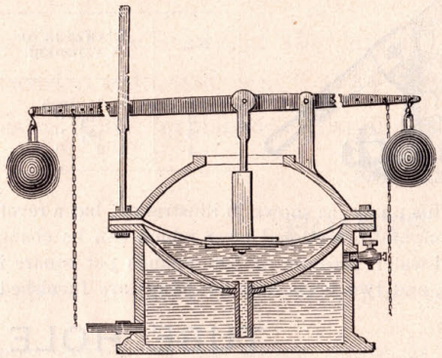
FOR HIGH PRESSURE.



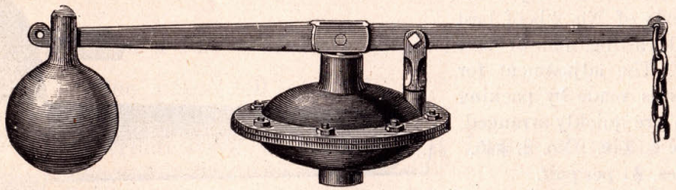
Numbers	1	2	3
For Boilers, Horse Power and under	5	20	30
Price	$10	$15	$25

DAMPER REGULATORS FOR LOW PRESSURE.





LOW PRESSURE REGULATOR, WITH COLD WATER RESERVOIR, AND WITH INDEPENDENT DOORS.

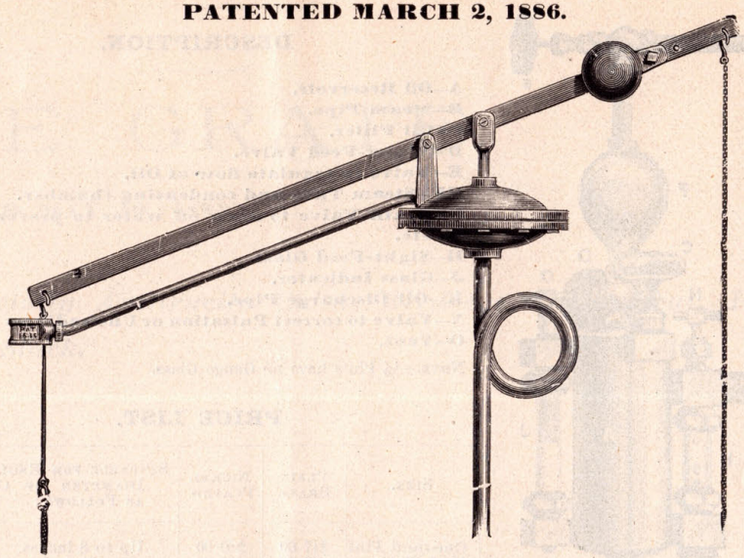


CHEAP PATTERN LOW PRESSURE DAMPER REGULATOR.

With Cold Water Reservoir and with Independent Doors $15 00
" " " without Doors 12 00
Cheap Pattern, 7-inch Plates 5 00
" 9 " 7 50

DAMPER REGULATOR, WITH SAFETY ATTACHMENT.

PATENTED MARCH 2, 1886.



Nearly all low pressure heating apparatus are controlled automatically by means of a regulator consisting of a flexible diaphragm made of rubber, which is a perishable material, likely to crack after being used a comparatively short time. and finally to rupture when some trifling excess of pressure beyond what has commonly been used is applied to it.

When this does occur it is self evident that the diaphragm, together with the post and lever above it, will at once drop to the same position as that in which they stand when there is no pressure on the boiler, the effect of which is to close the air door above the fire and to open the ash-pit door to its fullest extent.

The boiler at once "runs away" and if there is no one fortunately at hand to reverse the position of the doors and check the fire the consequences are likely to be serious, the least evil being that of blowing out the water through the safety valve and burning the boiler.

Such an accident is most likely to take place at the very time that the results are likely to be the most harmful; that is, when there is a large fire, with the furnace full of burning coal.

Occurring, as is very possible, during a cold night, when all the household are asleep, the consequences can be imagined.

To avoid such accidents, this Regulator, with Safety Attachment, patented March 2, 1886, has been designed and is offered to the trade with the confident assurance that when appreciated, no prudent or careful steam-fitter will construct a low pressure boiler without using this Regulator, as with it such an accident as described above is impossible.

The attachment is constructed as follows:

Into the chamber of the Regulator, but above the diaphragm, is tapped a piece of ⅜-inch pipe, which extends laterally out as far as the lever to which the chain of the ash-pit door is usually attached.

The pipe terminates in a fitting of peculiar shape containing a slot through which slides a link of fusible metal—the latter being attached to and forming a part of the door chain.

In the event of the bursting of the diaphragm it is relieved of pressure and the lower door opens, but as the hot water and steam pass through the rupture they are at once conducted through the ⅜-inch pipe to the link, which, instantly melting, parts the chain, drops the door and checks the fire.

The cost is so little beyond that of ordinary regulators, when compared with the whole cost of an apparatus, as to form no excuse for not applying this Regulator.

All links are carefully made of an express alloy, which we guarantee to melt at 160° F.

With each regulator an extra link is furnished.

The attachment can be applied to all diaphragm regulators in use, on the latter being sent to us.

PRICES, WITH SAFETY ATTACHMENT.

Regulator, with 7-inch plates, including Gooseneck $8 00
" " 9 " " " " 12 00

JAMES BEGGS & CO., No. 9 DEY STREET, NEW YORK.

CHEAP FUEL.

IN this age of natural gas and close competition, the subject of cheap fuel for boiler furnaces has become a question of vital importance to manufacturers who use steam for power and who are located in parts of the country distant from the coal fields or the gas-producing districts.

We are constantly receiving letters of inquiry from all parts of the country with reference to this subject. We therefore take this opportunity to give the results of our experience, developed from an almost daily contact with this question during the past eight years or more. In the first place, we would call attention to the fact that certain kinds of fuel may be cheap in one part of the country and the reverse in another part. For instance, in the anthracite coal fields the waste product of the mines, commonly called culm, has proved to be a most excellent fuel for steam purposes and is now being successfully used by the largest manufacturers and producers in the coal region, such as steel mills, collieries, silk mills, gas and electric light plants, etc. The cost of this fuel at the mines is merely nominal, but in order to burn it successfully it should contain at least fifty per cent. of buckwheat and should be fresh from the mine, for when the buckwheat is nearly all screened out of it, or when it has been exposed to the weather for any considerable length of time, it is comparatively worthless as fuel. Again, it will not pay to ship it any great distance, as the freight on culm is just as much per ton as it is on buckwheat coal, which for steam purposes is a much better fuel than culm, and costs at the mine only from thirty to thirty-five cents per ton more than culm. We, therefore, never advise the use of culm outside of the anthracite coal fields.

Anthracite screenings, the waste product of coal yards and points of reshipment, also make an economical fuel where they can be bought cheap and are not screened too closely. But owing to the fact that screenings usually have to remain out in the weather for some time before they are sold, it will be found advantageous to mix them with about one-fifth of their bulk of bituminous slack, where it can be obtained at reasonable rates.

Bituminous slack, alone, also makes an excellent cheap fuel in the soft coal districts. But among all the various kinds of cheap fuel, our experience has led us to give the preference to anthracite buckwheat coal. As a rule it contains less slate, burns steadier with blast, needs less attention, produces a larger volume of flame, and makes as hot a fire as should be put under a boiler, and when used in connection with proper appliances, will generate nearly, if not quite, as much steam per pound of fuel as that generally produced by using the highest priced coals in the market. In fact, the owners of some of the plants that we have fitted up with our appliances claim that they now make more steam per pound of fuel with buckwheat than they did when they were burning egg coal by the old method. Anthracite birdseye, which is a size still smaller than buckwheat, is now being quite extensively used for steam purposes, and is a very good fuel. When properly burned it produces a strong, steady heat, almost equal to buckwheat.

THE McCLAVE GRATE.

PATENTED NOV. 21, 1882, AND MAY 19, 1885.

Adapted to Burn all kinds and sizes of Hard or Soft Coal, especially Anthracite Culm, Birdseye, Buckwheat, Pea Coal and Bituminous Slack.

It has been adopted throughout by many of the largest concerns in the country, such as steel mills, wire mills, paper mills, steam heat companies, factories, soda ash works, collieries, etc. Over 3,400 square feet furnished for the pipe line of the National Transit Company alone. A long list of references will be furnished on application.

POINTS OF EXCELLENCE.

It has a fire surface especially adapted to prevent fine unconsumed fuel from running through into the ash pit. (See page 39.)

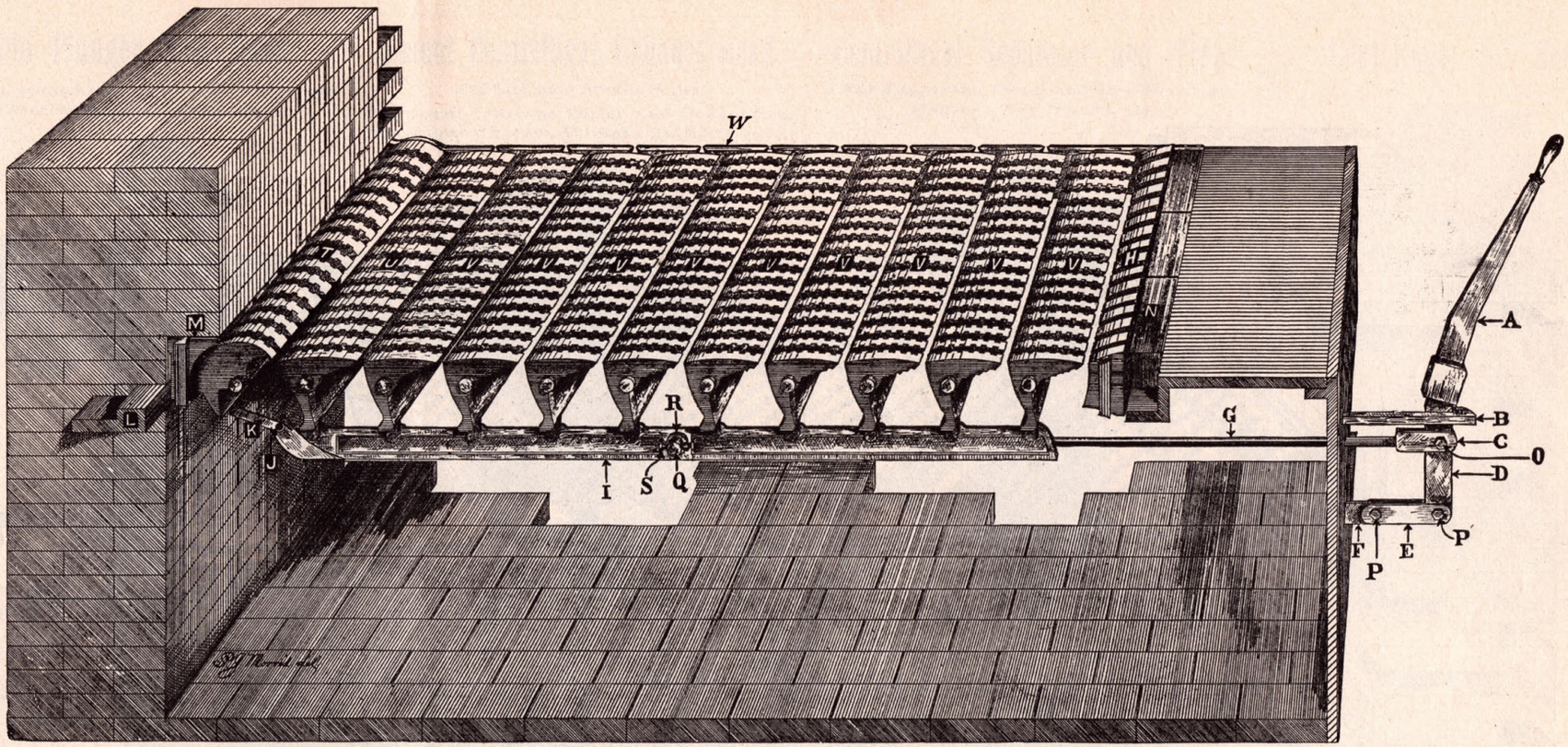
It has a thorough shaking movement, in which there is no increase in size of openings. This movement is well adapted to break up a soft coal fire when it cakes, or to remove the fine ashes from a hard coal fire when there is little, if any, clinker formed. (See page 40.)

It also has an absolute cut-off movement that will break up and remove clinkers instantly without wasting the fire. (See page 41.)

It will clean a fire uniformly from front to rear, the grate-bars at the bridge wall being crescent-shaped, so that they may operate closely to the wall. (See pages 40 and 41.)

It is constructed on principles that insure durability, there being no long lines of metal in contact with the fire.

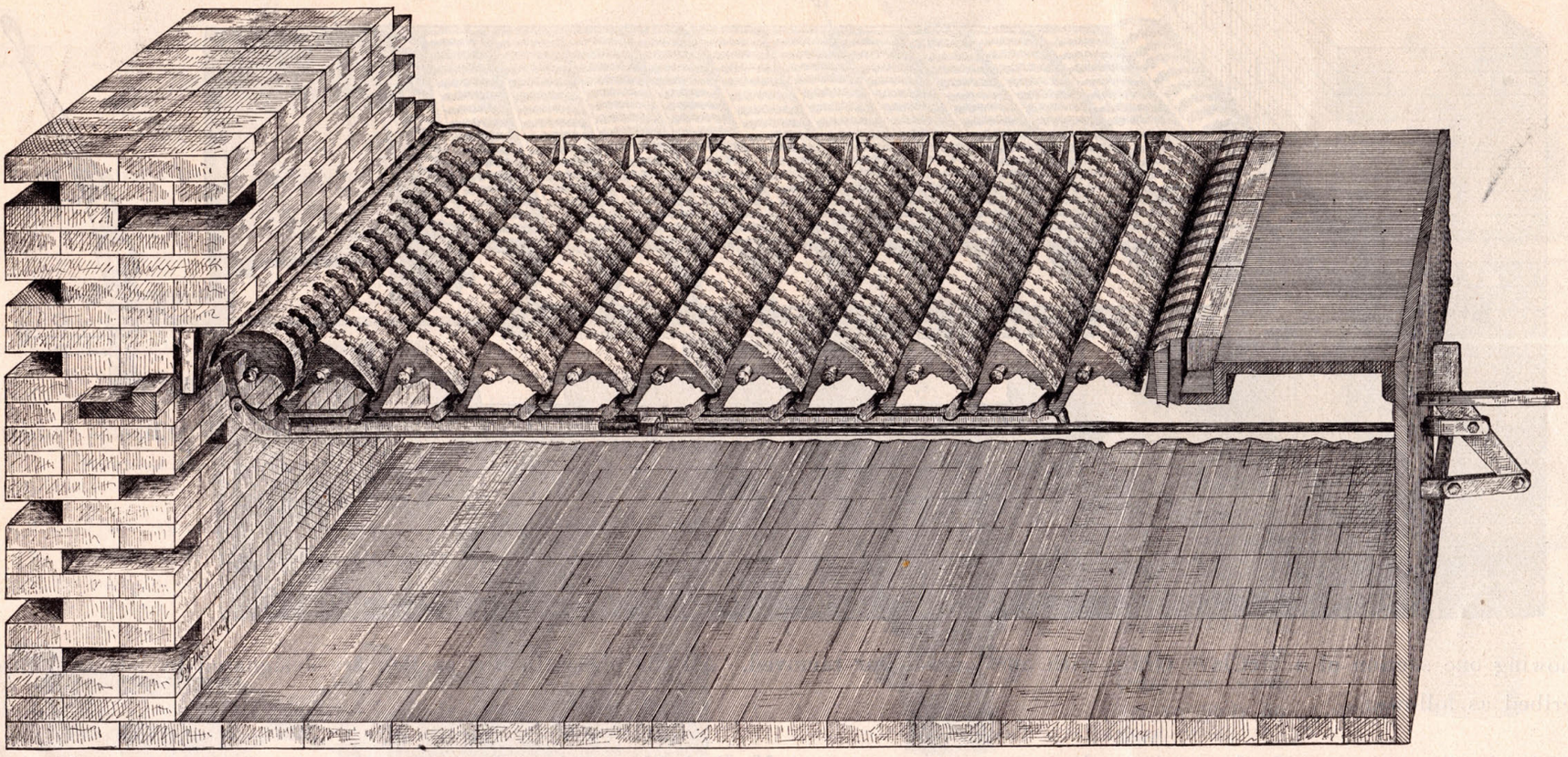
JAMES BEGGS & CO., No. 9 DEY STREET, NEW YORK.



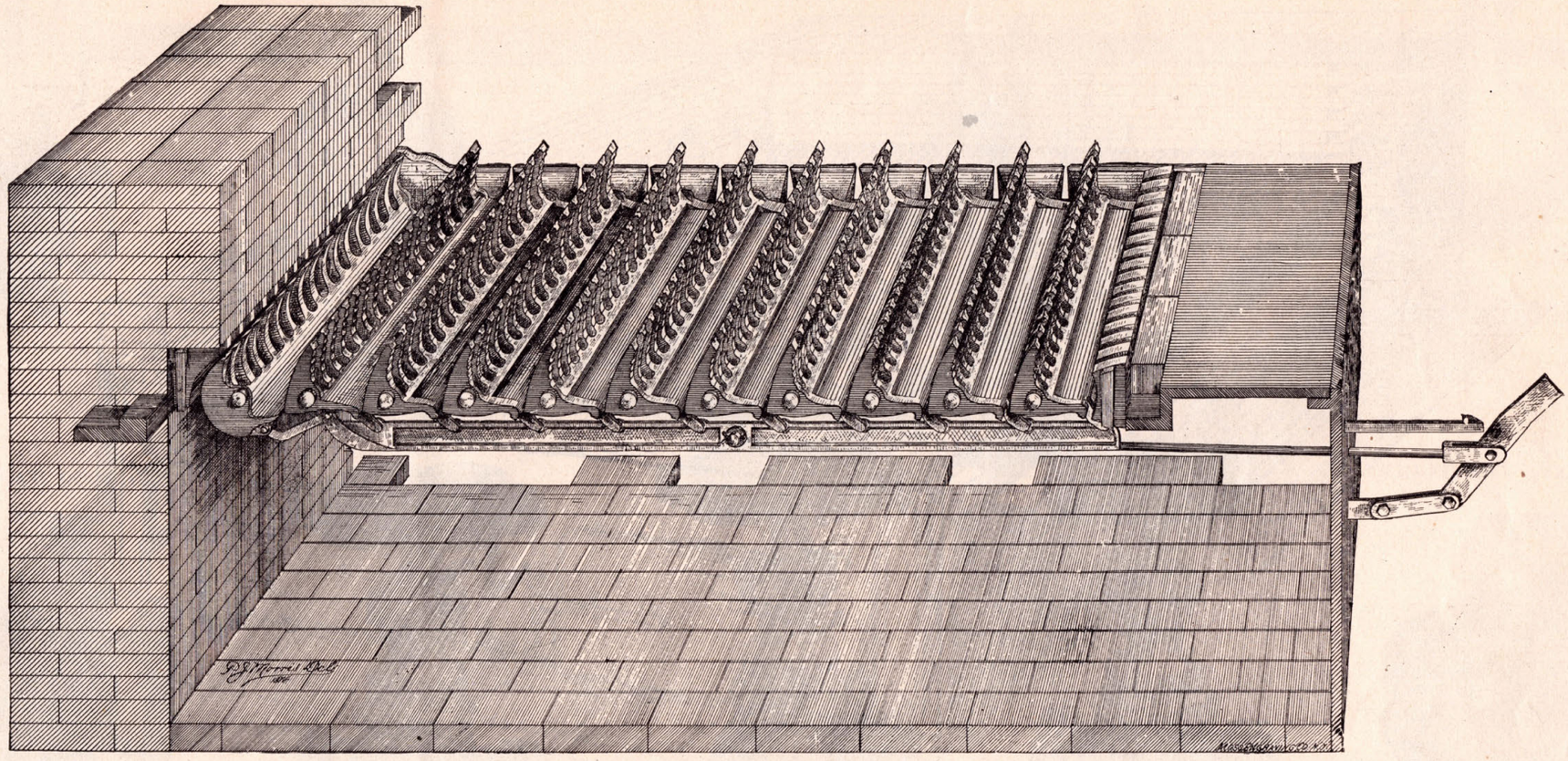
Showing one section of a McClave Grate, with one journal bar removed. All the pieces in this section are designated by letters, and are named and described as follows:

A, Socket handle.
B, Stop.
C, Jaw of connecting-rod.
D, Stub-lever.
E, Fulcrum straps.
F, Fulcrum stud.
G, Connecting-rod.
H, Front frame end.
I, Working bar.
J, $\frac{1}{2}$-inch bolt or pin for W. B. extension.
K, Working bar extension.
L, Back bearing bar.
M, Back frame end.
N, Fire-brick filling at front end of grate.
O, $2\frac{1}{2}$ inches by $\frac{5}{8}$ inch bolt.
P, 2 inches by $\frac{5}{8}$ inch bolts.
Q, Eye-bolt for connecting-rod.
R, Eye-bolt washer.
S, Cotter, or split pin.
T, Crescent bar.
U, Heel bar.
V, Regular grate-bar.
W, Top edge of journal bar.

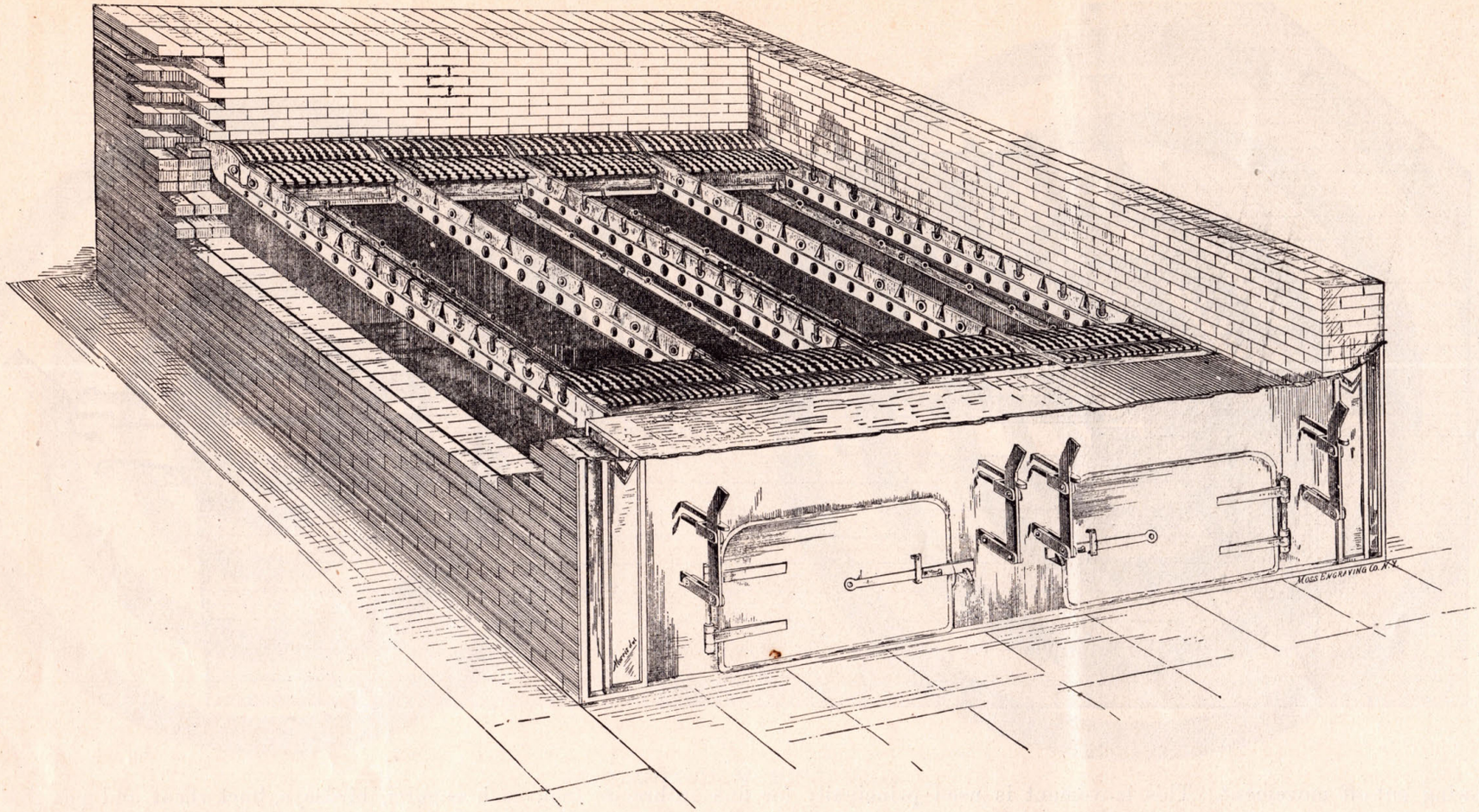
For explanation of grate-bars and journal bars see description on page 43. Large grates are made up by putting such sections together, and as we have patterns to make sections of different widths, also journal bars of different lengths, we can make a grate of almost any required size. The above schedule of pieces will enable any person to send for repairs without liability of mistakes. In ordering grate-bars for repairs always give the length of the bar on top, and on line with, but not including, the journals, and state whether the working bar journal is on the right or left hand end of the bar (looking at the bar from the front of the furnace), as this determines whether they are right or left hand bars. Also state whether you want crescent bars, heel bars or regular grate-bars. [NOTE.—For names of other parts see page 43.]



One section of McClave Grate showing shaking movement. This movement is used principally for soft coal and anthracite egg coal. In this movement there is no increase of opening during the operation, the bars keeping equi-distant from each other in their travel from the normal position downward and return. To operate, place the socket handle on the stub-lever and thrust it inward until the shoulder of connecting rod jaw strikes the front, then return to the stop; repeat it as often as necessary, always having the stub-lever resting against the stop at the finish, as this indicates when the grate-bars are level. The tendency of soft coal is to cake, and it therefore needs to be broken up very often. To do this without opening the fire doors (thereby letting large volumes of air rush in over the top of the fire) has been a long-felt want, which is in a great measure supplied by this movement. An anthracite egg coal fire also needs to be shaken when there is an accumulation of fine ash all through the mass. When there are clinkers to be removed use the cut-off movement as shown on page 41.



Showing cut-off movement. This movement is used principally for fine anthracite fuel, such as culm, birdseye, buckwheat and pea coal. It has become a well-known fact among the best firemen that small anthracite fuels should not be shaken or stirred up in any manner until it becomes necessary to give the fire a thorough cleaning, then it should be cleaned as quickly as possible, in order to prevent the steam from running down. This movement mows the clinkers and ashes from the bottom of the fire quickly and thoroughly, without opening a fire door and without waste of fuel; especially is this true when the Argand Steam Blowers are used for blast, as the steam serves to keep the clinkers soft, and therefore easily crushed through into the ash pit. When a fan blast or a strong chimney draught is used the clinkers are generally larger and harder and therefore more difficult to cut down. Some varieties of fine coal form large clinkers on the grate, in which case the lever should not be pulled out to the full extent of the cut-off movement but should be vibrated quickly back and forth about half way in on the shaking movement and half way out on the cut-off movement; this action will cut away the clinkers a little at a time and lessen the liability of breaking up the surface of the fire during the process of cleaning



McClave Grate of four sections, showing one method of arranging journal bars, connecting-rods, levers, etc. In this case there is an open journal bar on each side and one in the center. The order may be reversed, viz.: Closed bars at the side and center, and open bars between, in which case the levers should be arranged horizontally; but it should be borne in mind that whichever way the grates are made at first, that is the way they must be put in the furnace, as they cannot be changed around at will afterward. The levers shown on this page are vertical, but they can be placed horizontally between the ash pit and fire doors, if so desired.

A pair of stub-levers can be placed vertically between the ash pit doors in a space $4\frac{1}{2}$ inches wide, as one stop (made out of iron 1 inch by $1\frac{3}{4}$ inches, with a catch on both edges) will serve for both stub-levers and will occupy less space than two stops.

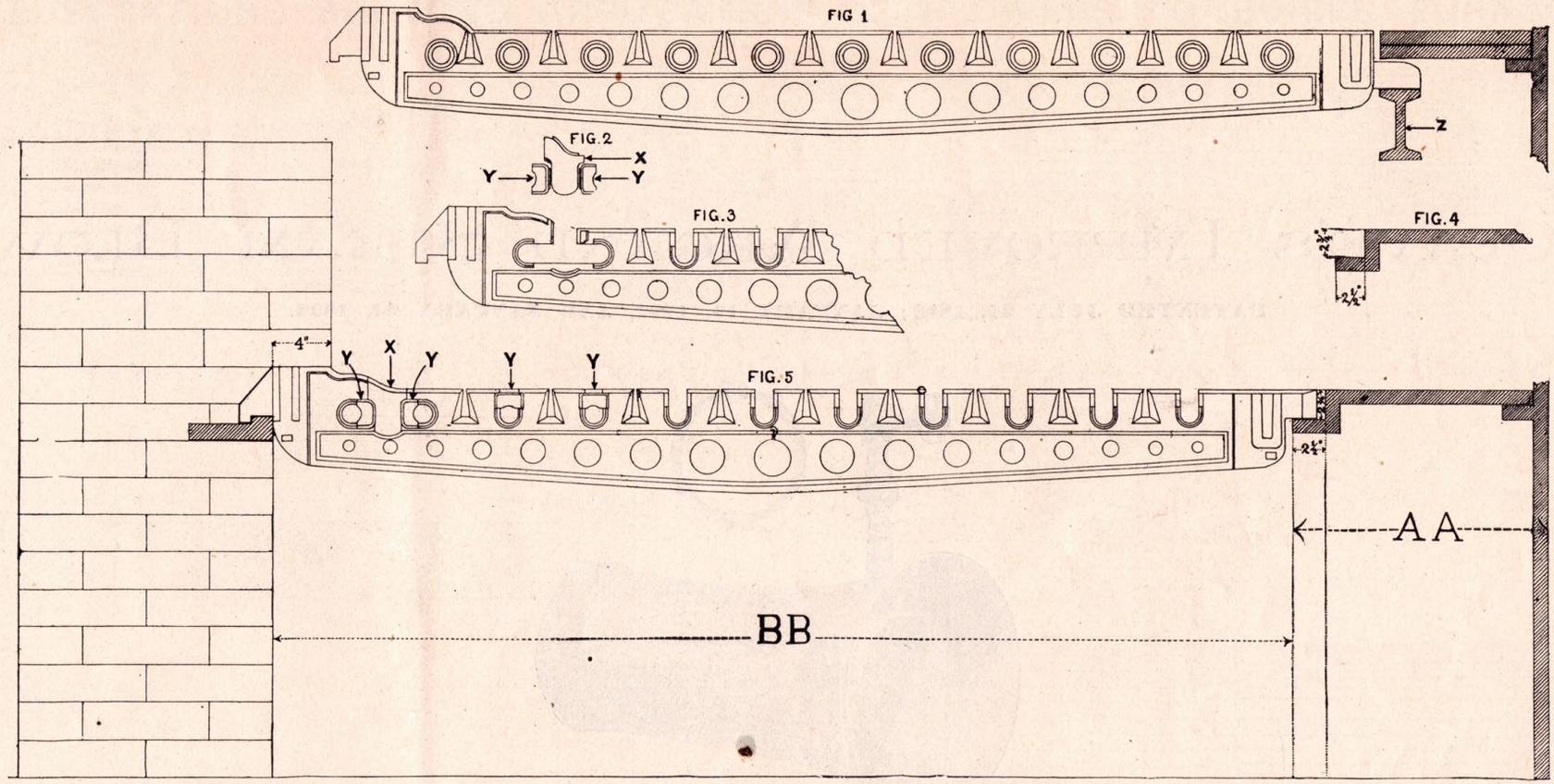


Figure 1 shows a closed journal bar with the nib at front end cut down so that it will go under the dead plate; also a different kind of front bearer than that formed by a rabbet in dead plate. This manner of arranging the front end of journal bar is special, and rarely used. Figure 2, on this plate, shows the two journal caps and keys which complete the journal boxes in back end of open journal bar, Figure 3. Figure 4 shows rabbet of dead plates, and gives dimensions to make the same in order to suit the McClave Grate, viz.: $2\frac{3}{4}$ inches deep by $2\frac{1}{2}$ inches projection. Figure 5 shows an open journal bar with the caps and keys in place at the back end. After the grate-bars are in place, journal caps are placed over every journal, to prevent the fire from pocketing below the surface of the grate. Figure 5 also shows our regular manner of arranging the front end of all journal bars open and closed, unless specially ordered otherwise; also position of back bearing bar, and the distance that the bridge wall projects forward on the back end of grate frame. We have patterns to make different lengths (taking measurements between the points above shown), as follows:

3 feet $0\frac{1}{2}$ inch	3 feet $6\frac{1}{2}$ inches	4 feet $0\frac{1}{2}$ inch	4 feet $6\frac{1}{2}$ inches	5 feet $0\frac{1}{2}$ inch	5 feet $6\frac{1}{2}$ inches	6 feet 1 inch	6 feet 7 inches
7 feet 1 inch	7 feet $7\frac{1}{4}$ inches	8 feet $1\frac{1}{2}$ inches	8 feet $7\frac{1}{2}$ inches	9 feet $1\frac{1}{2}$ inches	10 feet $1\frac{1}{2}$ inches		

The above lengths include the allowance for expansion. We can make this grate almost any desired width. Grates up to four feet wide should have a quarter-inch expansion room on each side of the grate; above 4 feet there should be from three-eighths to one-half inch on each side the grate, according to its size. In ordering journal bars for repairs give the length as above, also state whether they are open or closed bars—the closed bar has round holes for the journals, see Figure 1, while the open bar is cut down from the top edge to the journal bearings, as shown in Figure 5.

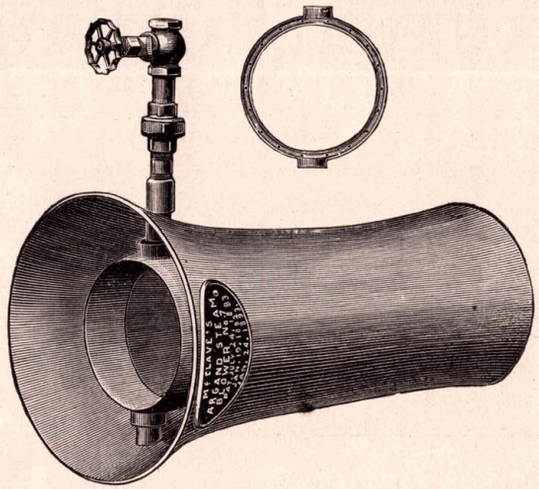
X, Key plug. Y, Journal caps. Z, Special front bearer with holes through panel for connecting rods to pass through.

AA, Distance from outside of front to inner edge of rabbet in dead plate.

BB, Length of journal bar between shoulders, including room for expansion.

McClave's Improved Argand Steam Blower.

PATENTED JULY 24, 1883; JANUARY 19, 1892, AND JANUARY 24, 1893.

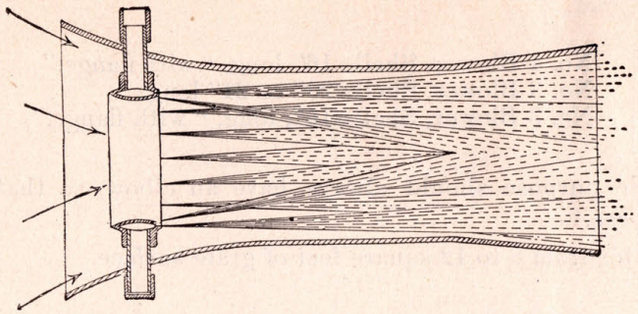


This Blower is constructed on scientific principles. It makes very little noise in operation. The air and steam is thoroughly mixed in the shell of the blower before the blast is delivered into the ash-pit. The jets from the ring issue in lines parallel with the longitudinal axis of the shell, while the central jets issue in lines sufficiently divergent to bring all the jets equi-distant from each other, and from the shell at or near the point where the blast begins to expand into the outlet frustum, thereby giving a more powerful action for drawing in air and thoroughly mixing same with the steam than can be obtained with a single jet blower of same steam delivery. This blower has been tested and approved by many of the best mechanical engineers in the country, and is especially adapted to burning all kinds of fine fuel, such as anthracite culm, birdseye, buckwheat, pea coal and bituminous slack, etc.

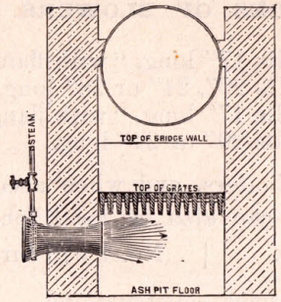
JAMES BEGGS & CO., No. 9 DEY STREET, NEW YORK.

ILLUSTRATIONS SHOWING APPLICATION OF BLOWERS TO BOILER FURNACES.

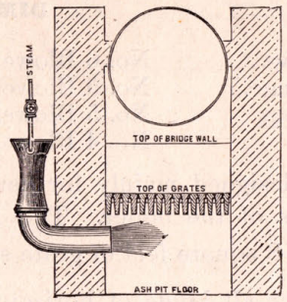
JAMES BEGGS & CO., No. 9 DEY STREET, NEW YORK.



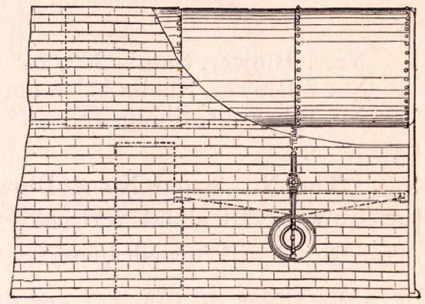
Longitudinal Section.



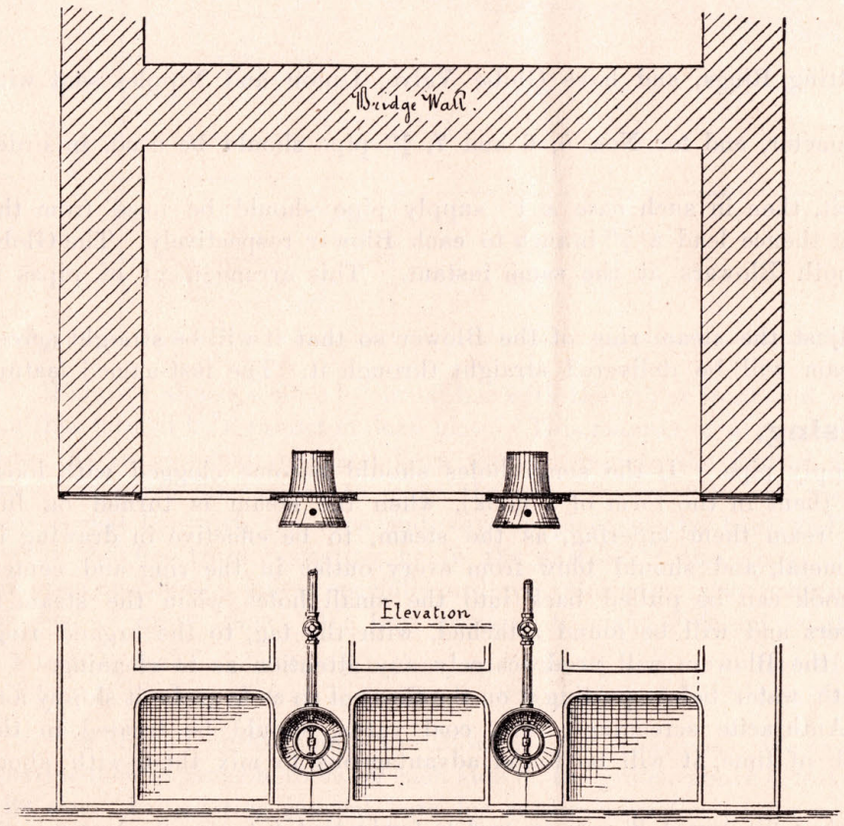
Method of placing a straight blower through side wall.



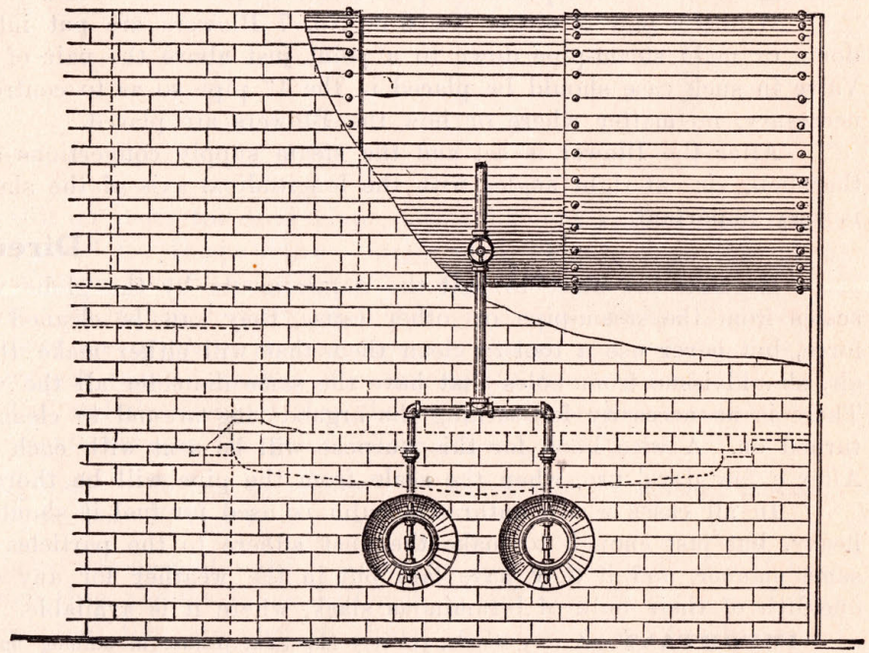
Method of placing a blower in side wall with elbow.



Side view of plate 2.



Plan and elevation for placing blower between ash doors through the front when there is sufficient space between the doors as is sometimes the case in nests of cylinder boilers; the blowers for this purpose are 17 inches long and have a flange on them to bolt to the front.



Method of connecting two blowers in side wall or front so that both will be controlled by one globe valve. This arrangement secures greater uniformity in the blast from both, and prevents the ashes from blowing out into the boiler room.

BLOWER DIRECTIONS.

DIMENSIONS OF BLOWERS.

No. 7 Blower, Shells 20″, 24″ or 28″ long.
No. 7 Blower, Shells 17″ long, "with flange."
No. 6 Blower, Shells 20″, 24″ or 28″ long.

No. 6 Blower, Shells 17″ long, "with flange."
No. 5 Blower, Shells 20″, 24″ or 28″ long.
No. 5 Blower, Shells 17″ long, "with flange."
No. 4 Blower, Shells 20″ or 24″ long.

No. 4 Blower, Shells 16″ long, "with flange."
No. 3 Blower, Shells 20″ or 24″ long.
No. 3 Blower, Shells 15″, long, "with flange."

The No. 3 and No. 4 Blowers are designed mainly for vertical boilers, and when used for such purpose should always have an elbow, so that the Blower will stand vertical by the side of the boiler. The No. 5 can also be used for this purpose.

No. 3 will furnish blast for from 4 to 8 square feet of grate surface. | No. 4 will furnish blast for from 8 to 12 square feet of grate surface.

The Nos. 5, 6 and 7 are designed for all kinds of horizontal furnace constructions.

No. 5 will furnish blast for from 12 to 20 square feet of grate surface. | No. 6 will furnish blast for from 20 to 30 square feet of grate surface.
No. 7 will furnish blast for from 30 to 45 square feet of grate surface.

A furnace having from 45 to 60 square feet of grate should be equipped with two No. 6 Blowers, and a furnace having from 60 to 91 square feet of grate should have two No. 7 Blowers.

All short Blowers, "with flange," are designed to go through from the front.

These Blowers are fitted up with McClave's latest improvement in Argand Jetting Rings, and have Globe Valve, Union and Nipples sent with each, ready to attach to the steam supply pipe from the boiler.

The steam supply pipe for the No. 3 and No. 4 Blower should be ½″ in diameter, and for Nos. 5, 6 and 7, ¾″ pipe should be used, in order to bring the full steam pressure from boiler to points of outlet.

Where a pair of either No. 6 or No. 7 Blowers are put into the same ash pit, then in such case a 1″ supply pipe should be used from the dome or main steam-pipe down to a point just above the pair of Blowers, and from thence lead a ¾″ branch to each Blower respectively. The Globe Valve in such case should be placed in the 1″ pipe so as to control the steam in both Blowers at the same instant. This arrangement of pipes is necessary, no matter where or how the Blowers are placed.

After the Blower is set and the steam supply connections are made, then adjust the steam ring of the Blower so that it will be straight across the shell, viz.: at right angles with the longitudinal axis of the shell so that the steam will be delivered straight through it. The last-named feature is very important.

Directions for Using.

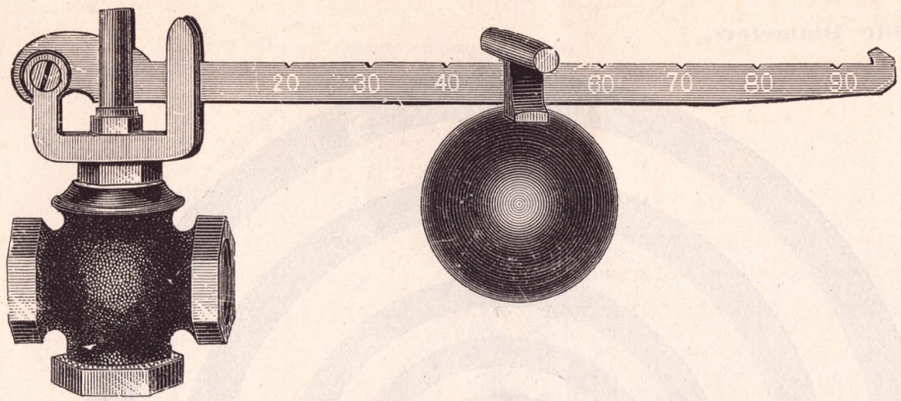
Regulate the blast to suit the requirements by the globe valve in steam supply pipe. If the small holes should become clogged with loose scales from the steam-pipe or other cause, they can be cleaned with a small wire (bent in the form of a hook), when the steam is turned on full force, but never use a tool to clean them that will either make the holes larger or ream them tapering, as the steam, to be effective in drawing in air, should issue from holes that have the same diameter all the way through the metal, and should blow from every outlet in the ring and center. There is no necessity for turning the argand ring around to clean it as the wire hook can be pulled back into the small holes when the steam is turned on. A wire hook for this purpose will be sent with each shipment of Blowers and will be found attached, with the tag, to the argand ring. After a few days' use, when the scale from the pipe will be thoroughly blown out, the Blowers will need scarcely any attention as to cleaning.

In all cases where anthracite culm is used for fuel it should be sprinkled with water before putting it on the fire, not so as to make it sloppy and heavy, but just enough to make the dust adhere to the particles of buckwheat. Anthracite screenings, from coal yards, should be treated in the same manner, and if they have lain out in the weather for any considerable length of time, it will be found advantageous to mix them with about one-fifth of their bulk of bituminous slack, where it is available.

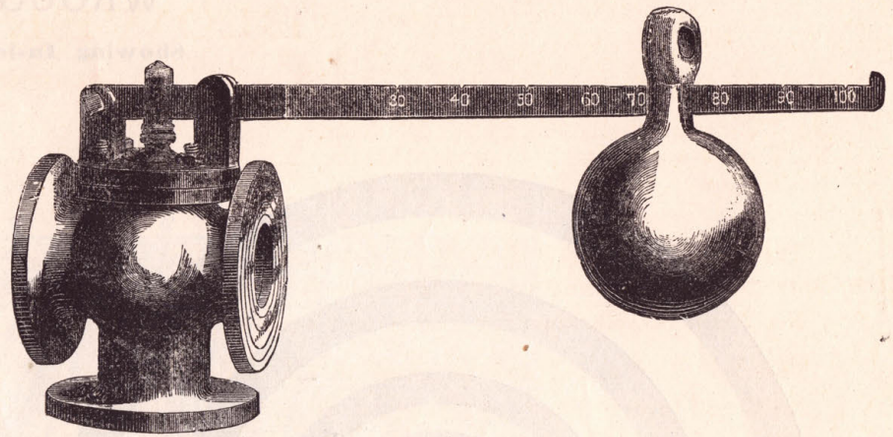
IMPORTANT.—A very simple, yet very important feature in burning fine fuels successfully, where the Argand Blowers are used to furnish blast, is to close the damper in the chimney, or stack, to a point where the burning gases will not blow out through the fire-door when opened, for where there is a strong chimney or stack draft in connection with under grate blowers, a large percentage of the gases escape without igniting. Therefore, do not fail to so regulate the damper that the largest possible volume of gaseous flame may be produced in the furnace. Where the chimney draft is weak, it may be necessary to keep the damper wide open, but we have found that in the majority of cases it is not only beneficial, but absolutely essential, to regulate the dampers as described, in order to produce the best results.

JAMES BEGGS & CO., No. 9 DEY STREET, NEW YORK.

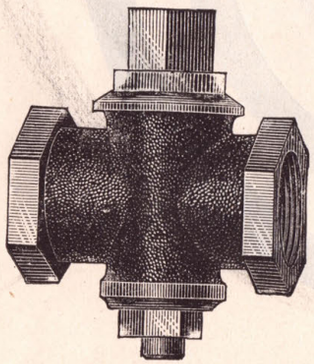
SAFETY-VALVE, SCREWED.



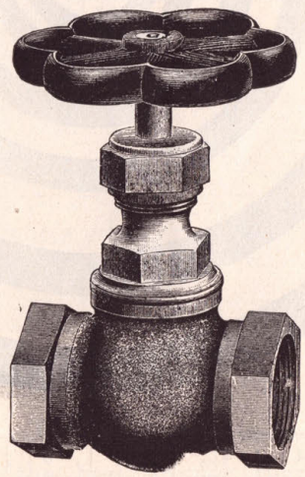
SAFETY-VALVE, FLANGED.



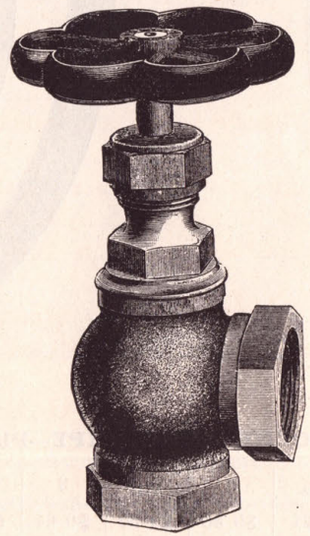
STEAM COCK.



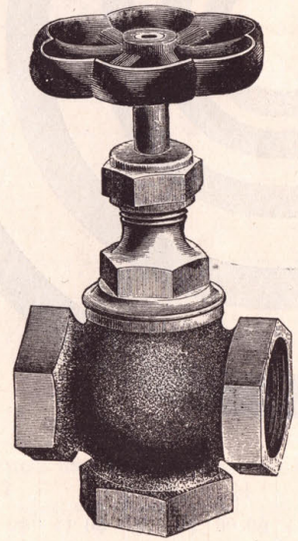
GLOBE VALVE.



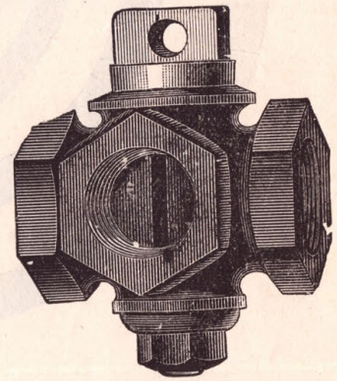
ANGLE VALVE.



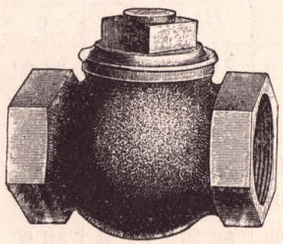
CROSS VALVE.



THREE-WAY STEAM COCK.

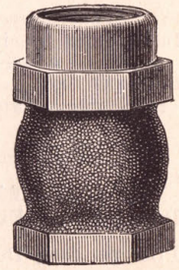


HORIZONTAL CHECK VALVE.



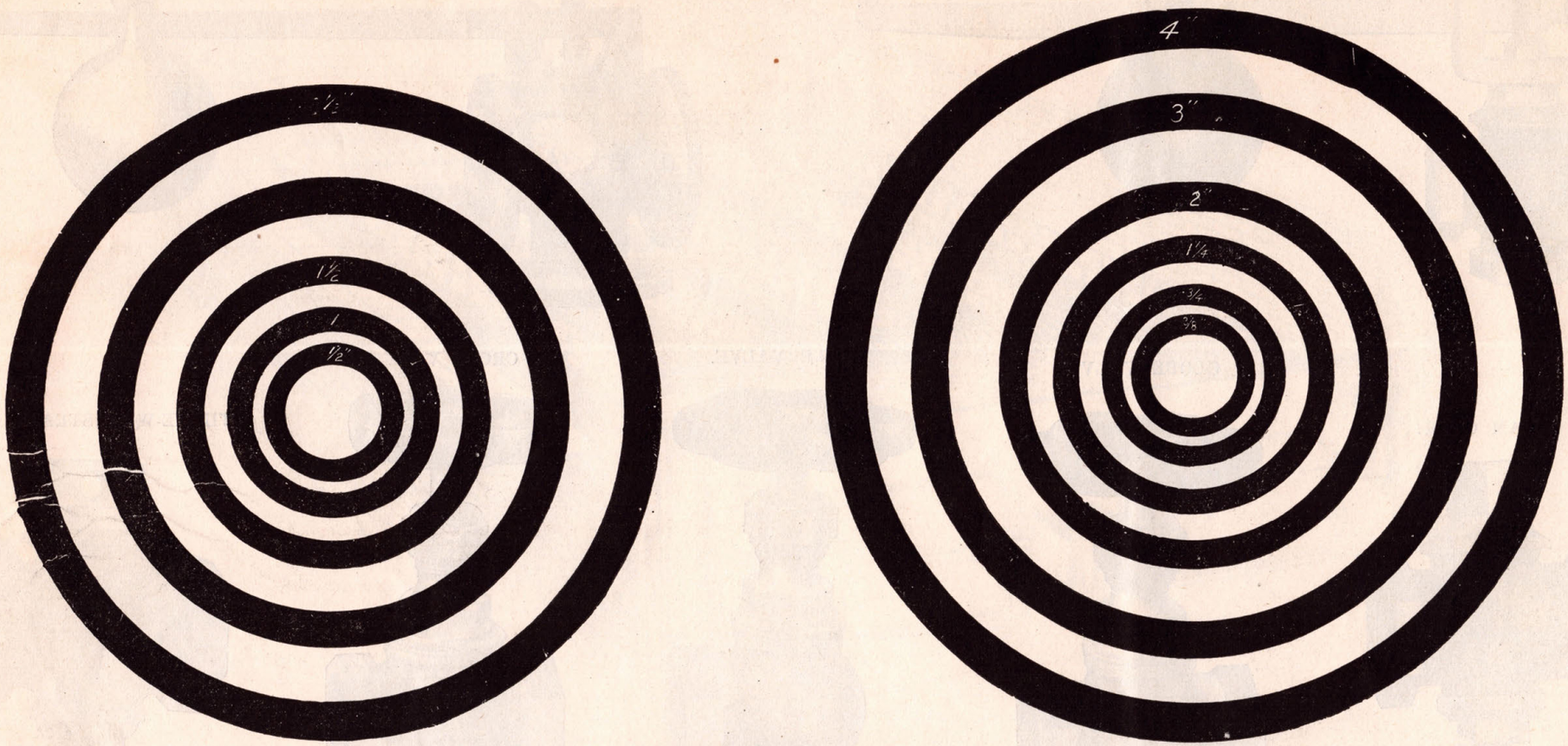
Size	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8
Iron Body Safety Valves—Screwed	...	....	....	....	$3 50	$5 00	$6 00	$8 00	$13 00	$18 00	$24 00	$30 00	$44 00	$60 00	.....
Iron Body Safety Valves—Flanged	....	....	...	....	....	....	....	10 50	16 00	22 50	29 25	36 00	50 00	67 50	$154 00
Brass Globe or Angle Valves	$0 60	$0 75	$1 00	$1 35	1 80	2 80	3 90	5 90	11 75	16 00	30 00	40 00	.. .	....	.....
Brass Globe or Angle Valves—Extra heavy	80	95	1 25	1 80	2 50	3 75	5 25	7 75	14 00	19 00	....	....	. ..	....	. ...
Brass Cross Valves	...	....	1 50	2 00	2 50	3 50	5 00	8 00	16 00	24 00	....	....	....	....	.....
Check Valves—Horizontal	50	60	85	1 15	1 55	2 30	3 25	5 20	10 00	14 00	....	....	....	....	.....
Check Valves—Vertical	....	....	85	1 15	1 55	2 30	3 25	5 20	10 00	14 00	....	....	....	....	.....
Steam Cocks	70	75	1 10	1 50	2 25	3 75	4 80	7 25	14 00	20 00	36 00	50 00	....	...	.....

VERTICAL CHECK VALVE.



WROUGHT-IRON PIPE.

Showing Inside and Outside Diameters.



WROUGHT-IRON PIPE—Plain.

Inside Diameter, inches.	⅛	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6	7	8	9	10	12
Price per foot.....	$0 04	$0 04	$0 04½	$0 06	$0 07½	$0 11	$0 14½	$0 24	$0 36	$0 50	$0 64	$0 76	$0 90	$1 06	$1 28	$1 65	$2 10	$2 75	$3 75	$4 75	$7 00
Weight per foot in lbs..	.24	.42	.56	.84	1.12	1.67	2.24	2.60	3.61	5.74	7.54	9.00	10.66	12.34	14.50	18.76	23.27	28 18	33.70	40.00	49.00

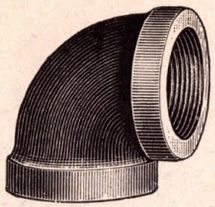
WROUGHT-IRON PIPE—Galvanized.

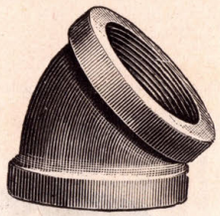
Inside Diameter, in inches.....	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6
Price per foot.....	$0 05	$0 05½	$0 08	$0 10	$0 14	$0 19	$0 28	$0 38	$0 57	$0 70	$0 90	$1 05	$1 31	$1 60	$2 00

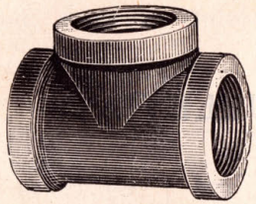
EXTRA STRONG AND DOUBLE-EXTRA STRONG WROUGHT-IRON PIPE.

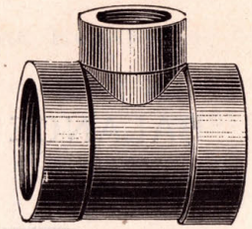
Size.....	⅛	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4
Price per foot, Extra Strong	$0 08	$0 08	$0 09	$0 12	$0 15	$0 22	$0 29	$0 48	$0 66	$1 00	$1 28	$1 52	$1 80
Price per foot, Double Extra Strong.....	$0 16	$0 16	$0 18	$0 24	$0 30	$0 44	$0 58	$0 96	$1 32	$2 00	$2 56	$3 04	$3 60

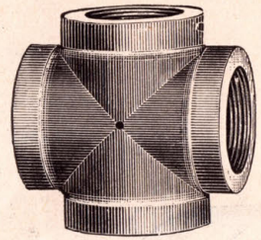
JAMES BEGGS & CO., No. 9 DEY STREET, NEW YORK.

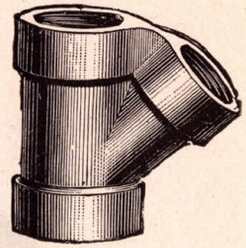

ELBOW.

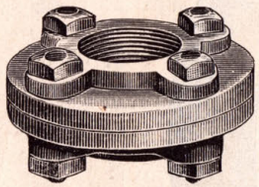

45° ELBOW.

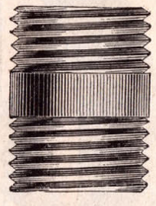

TEE.


REDUCING TEE.

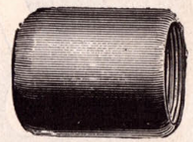

CROSS.

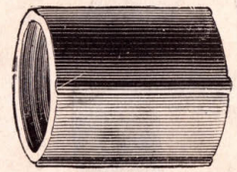

Y.

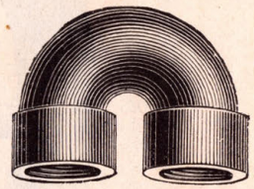

FLANGE UNION.


SHOULDER NIPPLE.

CLOSE NIPPLE.

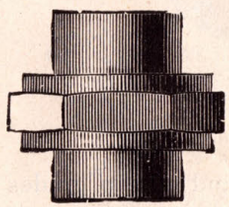

WROUGHT-IRON COUPLING.

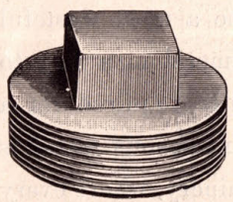

RIGHT AND LEFT COUPLING.

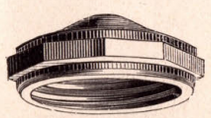

RETURN BEND, OPEN

FITTINGS FOR WROUGHT-IRON PIPE.

Size of Pipe.....inch	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6	7	8	9	10	12
Elbows ..... Cast-Iron	$0 04	$0 05	$0 06	$0 09	$0 13	$0 20	$0 25	$0 40	$0 75	$1 10	$1 35	$1 80	$2 50	$2 85	$3 90	$7 00	$10 00	$13 00	$20 00	$30 00
Reducing Elbows .... "	05	06	07	11	16	23	29	46	85	1 25	1 50	2 10	3 00	3 25	4 50	8 00	11 50	15 00	23 00	35 00
45° Elbows. ..... "	....	10	10	15	20	26	35	50	1 30	1 60	1 90	2 50	3 50	4 50	5 50	9 00	12 00	16 00	22 00	33 00
Side Outlet Elbows.. "	08	10	12	18	26	40	50	80	1 50	2 20	2 70	3 60	5 00	5 70	7 80	14 00	20 00	26 00	40 00	60 00
Tees ..... "	06	07	09	13	20	30	38	60	1 10	1 50	2 00	2 50	3 50	4 00	5 50	10 00	15 00	20 00	26 00	45 00
Reducing Tees..... "	07	08	11	15	23	35	44	70	1 25	1 75	2 30	2 90	4 00	4 60	6 35	11 50	17 00	23 00	30 00	50 00
Crosses ..... "	08	10	12	18	28	40	50	80	1 50	2 20	2 70	3 50	5 00	5 70	7 80	14 00	20 00	26 00	40 00	60 00
Reducing Crosses .... "	10	12	14	21	32	46	58	92	1 70	2 50	3 00	4 00	6 00	6 60	9 00	16 00	23 00	30 00	46 00	70 00
Y Branches ..... "	....	....	25	30	40	60	90	1 25	2 25	3 25	4 50	6 00	8 00	9 00	12 00	17 00	25 00	.....	.....	.....
Return Bends, Close.. "	....	...	10	15	22	34	45	75	1 50	2 25	....	....	....	....	....	.....	.....	... .	.....	.....
" Open.. "	....	....	15	20	30	48	68	1 15	1 75	2 75	....	....	....	....	....	.....	.....	.....	.....	.....
" Back Outlet	....	....	....	30	40	60	90	1 25	2 25	3 25	....	....	....	....	....	.....	.....	.....	.....	.....
Reducers.	05	06	09	12	18	25	36	50	75	1 20	1 50	2 00	2 75	3 00	4 00	8 00	10 00	12 00	15 00	.....
Caps	03	03	05	08	11	15	22	30	50	80	1 10	1 30	1 60	2 00	2 35	4 00	4 35	6 00	7 25	10 00
Locknuts.....	04	04	06	07	08	10	12	25	40	50	70	95	1 25	1 35	1 90	2 50	3 50	4 00	4 50	6 00
Nipples, Shoulder or Close	05	06	07	09	10	14	17	25	56	75	1 00	1 25	1 75	2 00	2 75	.....	.....	.....	.....	.....
" Long, 4 to 6 inch	07	09	10	11	15	20	25	35	75	95	1 25	1 60	2 25	2 60	3 60	4 20	6 00	7 50	9 00	13 00
" Extra Long, 6 to 12 in..	20	21	22	25	31	38	45	75	1 20	1 55	2 00	2 70	3 15	4 20	5 00	6 00	8 00	10 00	12 50	19 00
" Shoulder, R. & L.....	10	10	12	15	18	24	30	40	1 00	1 25	....	....	....	....	....	.....	.....	.....	... .	.....
" R. & L.. Long.... ...	12	14	16	20	24	35	46	60	1 30	1 60	2 00	2 40	....	....	....	.....	.....	.....	.....	.....
" Locknut.....	20	21	23	25	30	40	55	90	1 50	2 00	....	....	....	....	....	.....	.....	.....	.....	.....
Flange Unions	....	....	60	65	70	85	1 15	1 50	1 75	2 25	2 75	3 15	4 50	5 00	6 50	8 00	10 00	12 00	15 00	22 00
Dames' Flange Unions, with Washers	....	....	....	....	70	85	1 15	1 50	1 75	2 25	2 75	3 15	4 50	5 00	6 50	8 00	10 00	.....	15 00	22 00
Bushings.....	05	05	06	07	09	13	17	27	42	60	80	1 00	1 50	1 85	2 50	3 75	5 50	6 50	7 50	10 00
Plugs	03	03	04	05	06	10	13	20	35	50	75	85	1 35	1 75	2 40	3 75	5 50	6 50	7 50	10 00
" Countersunk.....	....	....	....	07	09	11	15	22	42	90	1 30	....	....	....	....	.....	.....	.....	.....	.....
Floor Plates.....	....	....	08	10	12	15	20	25	35	40	50	60	....	80	1 00	.....	.....	.....	.....	.....
Ceiling Plates	....	....	..	14	18	24	32	40	50	75	....	....	....	.. ..	....	.....	.. ..	.....	.....	.....
Malleable Iron Unions.....	15	18	20	28	34	46	60	80	1 50	2 10	3 00	4 00	....	....	....	.....	.....	.....	.....	.....
Wrought-Iron Couplings	05	06	07	10	13	17	21	28	40	60	80	1 00	1 50	1 65	2 40	3 25	4 25	.....	7 50	10 00
Right and Left Couplings	07	08	11	15	20	25	30	50	85	1 20	1 60	2 00	....	....	....	.....	....	.....	.....	.....
Long Screws	30	35	40	55	75	1 00	1 30	1 70	2 70	3 70	....	.....	....	... .	....	... .	.....	... .	.....	.....
Wrought-Iron Bends	....	....	50	60	75	1 00	1 50	2 50	5 75	8 50	10 00	12 00	....	....	....	.....	.....	... .	.....	.....

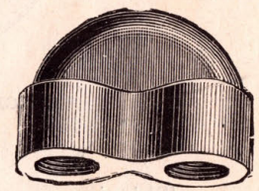

LIP UNION.

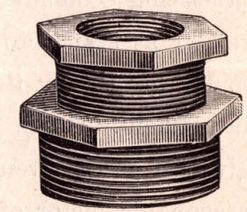

PLUG.

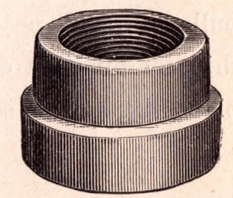

CAP.

GALVANIZED FITTINGS.

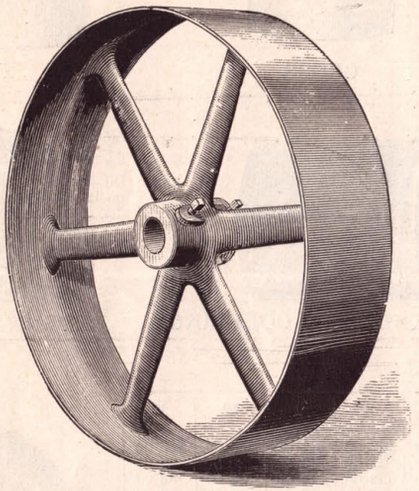
Size of Pipe.....inch	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6	7	8
Elbows.....	$0 06	$0 09	$0 12	$0 18	$0 30	$0 45	$0 55	$0 85	$1 60	$2 35	$3 10	$4 10	$6 00	$7 00	$11 00	$15 00	$20 00
45° Elbows.....	....	....	20	30	40	50	70	1 00	2 60	3 20	4 75	5 00	7 00	9 00	13 00	18 00	24 00
Tees	08	13	17	25	40	60	85	1 20	2 25	2 85	3 80	5 25	7 00	8 00	12 50	18 00	24 00
Crosses	15	18	23	35	55	80	1 00	1 60	3 00	4 25	5 50	7 00	9 00	10 50	16 00	23 00	35 00
Y Branches	....	....	50	60	80	1 20	1 80	2 50	4 50	6 50	9 75	12 00	....	18 00	24 00	34 00	50 00
Couplings.....	....	08	10	13	18	25	32	40	55	80	1 05	1 40	2 00	2 25	3 25	.....	... .
Nipples	07	08	09	11	13	17	23	32	65	1 00	1 25	1 45	2 00	2 40	3 50	.. .	.....
Long Nipples	09	11	13	16	19	24	31	40	85	1 20	1 50	1 90	2 40	3 00	4 40	.....	.....
Unions	20	24	27	37	50	70	90	1 20	2 25	2 90	4 50	5 60	....	.....	.....	.....	.....


RETURN BEND, CLOSE.

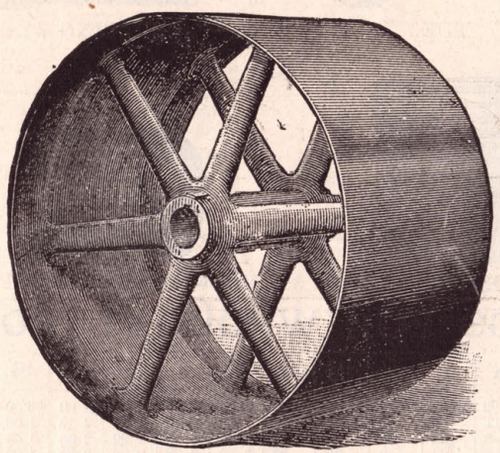

BUSHINGS.


REDUCER.

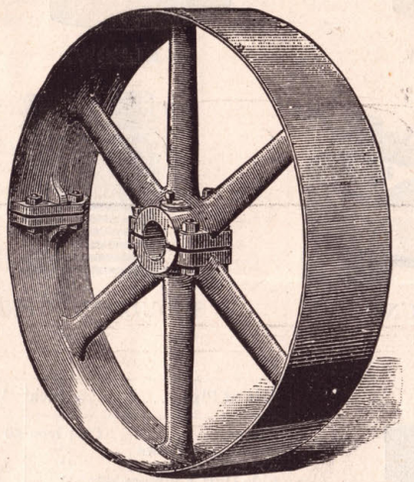
BALANCED PULLEYS.



SINGLE ARM WHOLE PULLEY.



DOUBLE ARM PULLEY—SPLIT OR WHOLE.



SINGLE ARM SPLIT PULLEY.

This is an age of imitation, when almost all tools used by machinists, carpenters and other mechanics are made of cast iron and cheap grades of steel, and are bought because they look well and can be had at low prices. When the purchaser comes to use such tools he finds that instead of practicing economy he has really been extravagant. Because these tools were polished up and had the same form it was expected that they would render as satisfactory service. After they were ground and put to their proper use, then their true value became known, and they were either used under protest by the workman or thrown into the scrap heap, and genuine tools purchased. A low-priced article may in the end be a most wasteful investment. It is not so with our pulleys, for in them we have spared no pains to design our patterns so as to distribute the metal in a way to give the most strength. While our pulleys look symmetrical and light their weight shows that they are much heavier than is really required for a reasonable factor of safety. The iron of which these pulleys are made is a special mixture, very strong and tough, so that extraneous metal is avoided. This is a very important consideration in cases where pulleys are used to drive electric lighting and other high speed machinery, where every extra ounce of metal beyond that which is required for strength increases the danger of bursting, or of throwing the pulley out of balance. Our pulleys are all neatly turned and balanced, and for fastenings we use steel set screws and keys, one or both, as may be required. The way we use this combination enables us to move a pulley with very little delay, and we do not have to *belt* away with a drift to get the key out. When in place the key is securely locked so that it cannot change its position until the set screws are loosened.

How to Calculate Speed and Diameters of Pulleys.

Let **A** represent diameter of driving pulley.
Let **B** represent revolutions per minute of driving pulley.
Let **C** represent diameter of driven pulley.
Let **D** represent revolutions per minute of driven pulley.

To find **D** multiply **A** by **B** and divide by **C.**
To find **C** multiply **A** by **B** and divide by **D.**
To find **B** multiply **D** by **C** and divide by **A.**
To find **A** multiply **D** by **C** and divide by **B.**

No algebra in this—simple multiplication and division.
For gearing substitute **NUMBER OF TEETH** for diameters.

How to Order Pulleys.

Give diameter and face.
State whether face is to be flat or round.
Flat face is for shifting belt, round face for non-shifting belt.
A pair of loose and tight pulleys should have round faces.
See how to order Loose Pulleys on Page 57.

Give exact bore. Do not write 2 inches instead of $1\frac{15}{16}$. Most shafts in use are of the diameters given in our list, but some are $\frac{1}{16}$ inch larger. Do not give the size as "full" or "scant." If the size cannot be expressed by ordinary rule measure, send us a nail or piece of wire filed to the exact size wanted.

If you want a keyseat, state the width and depth of keyseat in your shaft, and whether you want keyseat in pulley made straight or taper.

If you do not give full particulars we must write for them. Avoid loss of valuable time by stating exactly what you want.

Extra Charges on Pulleys.

Smallest fraction of bore, one-sixteenth of an inch. Any deviation therefrom will be charged extra.

For pulleys with an extra large bore in proportion to their diameter and face, an extra charge will be made.

Pulleys ordered from $\frac{1}{2}$ to $\frac{3}{4}$ inch wider than list sizes are charged for at the price of the next following width.

Pulleys have one or two set screws according to size.
Double belt pulleys have two set screws or a keyseat.
When both set screws and keyseats are wanted an extra charge will be made.
For loose pulleys, see page 57.
For flange pulleys, see page 57.
For clamp hub pulleys, see page 57.

FINISHED PULLEYS.

Bored, Turned, Balanced, with Keyways or Set Screws.

Diameter in Inches.	Width of Face	WHOLE. Single Belt.	SPLIT. Single Belt.
6	3	$1 30	$2 70
	4	1 45	2 85
	5	1 75	3 35
	6	2 00	3 60
	7	2 40	4 40
	8	2 75	4 75
7	3	1 50	2 90
	4	1 75	3 15
	5	2 00	3 60
	6	2 35	3 95
	7	2 95	4 95
	8	3 35	5 35
	9	3 75	5 75
	10	4 25	6 25
8	3	1 75	3 15
	4	1 95	3 35
	5	2 40	4 00
	6	3 00	4 60
	7	3 40	5 40
	8	3 70	5 70
	9	4 20	6 20
	10	4 40	6 40
	12	5 10	7 60
9	3	2 00	3 40
	4	2 30	3 70
	5	2 50	4 10
	6	2 80	4 40
	7	3 30	5 30
	8	3 80	5 80
	9	4 20	6 20
	10	4 30	6 30
	12	5 30	7 80
	14	6 10	8 60
10	3	2 30	3 70
	4	2 60	4 00
	5	3 00	4 60
	6	3 40	5 00
	7	3 60	5 60
10	8	$4 10	$6 10
	9	4 50	6 50
	10	4 80	6 80
	12	5 60	8 10
	14	6 40	8 90
11	3	2 55	3 95
	4	2 70	4 10
	5	3 15	4 75
	6	3 50	5 10
	7	3 80	5 80
	8	4 40	6 40
	9	4 70	6 70
	10	5 10	7 10
	12	5 90	8 40
	14	6 80	9 30
12	3	2 80	4 20
	4	3 10	4 50
	5	3 40	5 00
	6	3 70	5 30
	7	4 30	6 30
	8	4 60	6 60
	9	4 90	6 90
	10	5 40	7 40
	12	6 20	8 70
	14	7 30	9 80
13	3	2 90	4 40
	4	3 30	4 80
	5	3 70	5 70
	6	4 15	6 15
	7	4 55	7 05
	8	5 00	7 50
	9	5 40	7 90
	10	5 80	8 30
	12	6 60	10 10
	14	7 70	11 20
14	3	3 20	4 70
	4	3 60	5 10
	5	4 20	6 20
14	6	$4 50	$6 50
	7	4 90	7 40
	8	5 20	7 70
	9	5 70	8 20
	10	6 10	8 60
	12	7 10	10 60
	14	8 30	11 80
15	3	3 30	4 80
	4	3 80	5 30
	5	4 30	6 30
	6	4 70	6 70
	7	5 10	7 60
	8	5 50	8 00
	9	6 00	8 50
	10	6 50	9 00
	12	7 50	11 00
	14	8 80	12 30
16	3	3 50	5 00
	4	4 00	5 50
	5	4 50	6 50
	6	5 00	7 00
	7	5 50	8 00
	8	6 00	8 50
	9	6 50	9 00
	10	7 00	9 50
	12	8 00	11 50
	14	9 40	12 90
	16	10 80	14 30
17	3	3 70	5 20
	4	4 20	5 70
	5	4 70	6 70
	6	5 20	7 20
	7	5 70	8 20
	8	6 20	8 70
	9	6 80	9 30
	10	7 40	9 90
	12	8 50	12 00
	14	10 00	13 50
	16	11 70	15 20

FINISHED PULLEYS.—Continued.

Bored, Turned, Balanced, with Keyways or Set Screws.

Diameter in Inches.	Width of Face.	WHOLE.		SPLIT.	
		Single Belt.	Double Belt.	Single Belt.	Double Belt.
18	3	$3 85	$5 65	$5 35	$7 15
	4	4 40	6 20	5 90	7 70
	5	4 95	6 75	6 95	8 75
	6	5 50	7 30	7 50	9 30
	7	6 05	8 05	8 55	10 55
	8	6 60	8 75	9 10	11 25
	9	6 85	9 55	9 35	12 05
	10	7 90	10 30	10 40	12 80
	12	9 10	11 85	12 60	15 35
	14	10 80	13 80	14 30	17 30
	16	12 50	15 85	16 00	19 35
	18	14 90	18 50	18 40	22 00
19	3	4 00	5 85	6 60	8 45
	4	4 50	6 60	7 10	9 20
	5	5 15	7 10	8 35	10 30
	6	5 80	7 60	9 00	10 80
	7	6 40	8 40	10 40	12 40
	8	7 00	9 15	11 00	13 15
	9	7 80	10 10	11 80	14 10
	10	8 30	10 70	12 30	14 70
	12	9 70	12 60	14 70	17 60
	14	11 50	14 70	16 50	19 70
	16	13 40	16 85	20 00	23 45
	18	16 10	19 85	22 70	26 45
20	3	4 55	6 35	7 15	8 95
	4	4 90	6 70	7 50	9 30
	5	5 55	7 35	8 75	10 55
	6	6 20	8 00	9 40	11 20
	7	6 85	8 80	10 85	12 80
	8	7 50	9 65	11 50	13 65
	9	8 20	10 50	12 20	14 50
	10	8 90	11 30	12 90	15 30
	12	10 30	13 30	15 30	18 30
	14	12 30	15 65	17 30	20 65
	16	14 30	17 90	20 90	24 50
	18	17 40	21 35	24 00	27 95
	20	20 80	25 00	27 40	31 60

Diameter in Inches.	Width of Face.	WHOLE.		SPLIT.	
		Single Belt.	Double Belt.	Single Belt.	Double Belt.
21	4	$5 15	$7 00	$7 75	$9 60
	5	5 80	7 65	9 00	10 85
	6	6 50	8 30	9 70	11 50
	7	7 20	9 20	11 20	13 20
	8	7 90	10 00	11 90	14 00
	9	8 65	11 00	12 65	15 00
	10	9 40	11 80	13 40	15 80
	12	11 00	14 15	16 00	19 15
	14	13 10	16 55	18 10	21 55
	16	15 30	19 05	21 90	25 65
	18	18 40	22 45	25 00	29 05
	20	22 00	26 35	26 60	32 95
22	4	5 30	7 10	7 90	9 70
	5	6 10	7 90	9 30	11 10
	6	6 85	8 65	10 05	11 85
	7	7 75	9 60	11 75	13 60
	8	8 40	10 55	12 40	14 55
	9	9 20	11 40	13 20	15 40
	10	10 00	12 40	14 00	16 40
	12	11 80	15 15	16 80	20 15
	14	13 90	17 50	18 90	22 50
	16	16 40	20 35	23 00	26 95
	18	19 70	23 90	26 30	30 50
	20	23 40	28 00	30 00	34 60
23	4	5 60	7 75	8 20	10 35
	5	7 20	8 60	10 40	11 80
	6	7 40	9 50	10 60	12 70
	7	8 15	10 40	12 15	14 40
	8	8 90	11 30	12 90	15 30
	9	9 75	12 55	13 75	16 55
	10	10 60	13 35	14 60	17 35
	12	12 50	16 10	17 50	21 10
	14	14 80	18 75	19 80	23 75
	16	17 50	21 70	24 10	28 30
	18	20 90	25 45	27 50	32 05
	20	24 60	29 40	31 20	36 00

Diameter in Inches.	Width of Face.	WHOLE.		SPLIT.	
		Single Belt.	Double Belt.	Single Belt.	Double Belt.
24	4	$5 90	$8 10	$9 90	$12 10
	5	6 70	8 90	10 70	12 90
	6	7 50	9 65	11 50	13 65
	7	8 45	10 80	13 45	15 80
	8	9 40	11 80	14 40	16 80
	9	10 35	13 00	15 35	18 00
	10	11 30	14 00	16 30	19 00
	12	13 30	16 90	19 80	23 40
	14	15 70	19 65	22 30	26 15
	16	18 70	22 90	27 70	31 90
	18	22 10	26 65	31 10	35 65
	20	26 00	30 80	35 00	39 80
25	4	6 50	8 75	10 50	12 75
	5	7 40	9 70	11 40	13 70
	6	8 30	10 55	12 30	14 55
	7	9 10	11 60	14 10	16 60
	8	10 00	12 55	15 00	17 55
	9	10 95	13 70	15 95	18 70
	10	11 90	14 75	16 90	19 75
	12	14 10	17 85	20 60	24 35
	14	16 70	20 75	23 20	27 25
	16	19 80	24 15	28 80	33 15
	18	23 30	27 95	32 30	36 95
	20	27 30	32 25	36 30	41 25
26	4	6 90	9 30	10 90	13 30
	5	7 80	10 20	11 80	14 20
	6	8 70	11 10	12 70	15 10
	7	9 65	12 30	14 65	17 30
	8	10 60	13 35	15 60	18 35
	9	11 65	14 60	16 65	19 60
	10	12 70	15 70	17 70	20 70
	12	15 00	18 95	21 50	25 45
	14	17 70	21 90	24 20	28 40
	16	20 90	25 45	29 90	34 45
	18	24 50	29 30	33 50	38 30
	20	28 70	33 85	37 70	42 85

Diameter in Inches.	Width of Face.	WHOLE.		SPLIT.	
		Single Belt.	Double Belt.	Single Belt.	Double Belt.
27	4	$7 20	$9 75	$11 20	$13 75
	5	8 25	10 85	12 25	14 85
	6	9 30	11 85	13 30	15 85
	7	10 30	13 00	15 30	18 00
	8	11 30	14 15	16 30	19 15
	9	12 40	15 45	17 40	20 45
	10	13 50	16 65	18 50	21 65
	12	16 00	20 05	22 50	26 55
	14	18 70	23 05	25 20	29 55
	16	22 00	26 65	31 00	35 65
	18	25 60	30 55	34 60	39 55
	20	30 10	35 35	39 10	44 35
28	4	7 60	10 35	11 60	14 35
	5	8 30	11 50	12 30	15 50
	6	9 90	12 65	13 90	16 65
	7	10 90	13 80	15 90	18 80
	8	11 90	14 90	16 90	19 90
	9	13 70	16 20	18 70	21 20
	10	14 30	17 65	19 30	22 65
	12	16 90	21 10	23 40	27 60
	14	19 70	24 25	26 20	30 75
	16	23 10	27 90	32 10	36 90
	18	26 90	32 05	35 90	41 05
	20	31 50	36 90	40 50	45 90
29	4	8 00	10 85	12 00	14 85
	5	9 25	12 15	13 25	16 15
	6	10 50	13 35	14 50	17 35
	7	11 50	14 50	16 50	19 50
	8	12 50	15 65	17 50	20 65
	9	13 80	17 05	18 80	22 05
	10	15 10	18 45	20 10	23 45
	12	17 80	22 15	24 30	28 65
	14	20 80	25 45	27 30	31 95
	16	24 20	29 15	33 20	38 15
	18	28 00	33 25	37 00	42 25
	20	32 90	38 45	41 90	47 45

HOW TO ORDER PULLEYS, PAGE 51. EXTRA CHARGES, PAGE 51.

FINISHED PULLEYS.—Continued.

Bored, Turned, Balanced, with Keyways or Set Screws.

Diameter in Inches.	Width of Face.	WHOLE.		SPLIT.	
		Single Belt.	Double Belt.	Single Belt.	Double Belt.
30	4	$8 50	$11 50	$12 50	$15 50
	5	9 80	12 85	13 80	16 85
	6	11 10	14 10	15 10	18 10
	7	12 20	15 40	17 20	20 40
	8	13 20	16 55	18 20	21 55
	9	14 60	18 00	19 60	23 00
	10	15 90	19 50	20 90	24 50
	12	18 70	23 25	25 20	29 75
	14	21 80	26 60	28 30	33 10
	16	25 40	30 55	34 40	39 55
	18	29 20	34 60	38 20	43 60
	20	34 30	40 05	43 30	49 05
31	4	9 00	12 15	14 00	17 15
	5	10 35	13 55	15 35	18 55
	6	11 70	14 85	16 70	19 85
	7	12 85	16 20	18 85	22 20
	8	14 00	17 45	20 00	23 45
	9	15 40	19 05	21 40	25 05
	10	16 80	20 55	22 80	26 55
	12	19 70	24 35	28 20	32 85
	14	22 90	27 85	31 40	36 35
	16	26 60	31 85	38 10	43 35
	18	30 50	36 05	42 00	47 55
	20	35 70	41 75	47 20	53 25
32	4	9 40	12 75	14 40	17 75
	5	10 85	14 20	15 85	19 20
	6	12 30	15 65	17 30	20 65
	7	13 55	17 00	19 55	23 00
	8	14 80	18 40	20 80	24 40
	9	16 20	20 00	22 20	26 00
	10	17 60	21 50	23 60	27 50
	12	20 60	25 40	29 10	33 90
	14	23 90	29 05	32 40	37 55
	16	27 70	33 10	39 20	44 60
	18	31 80	37 55	43 30	49 05
	20	37 10	43 45	48 60	54 95

Diameter in Inches.	Width of Face.	WHOLE.		SPLIT.	
		Single Belt.	Double Belt.	Single Belt	Double Belt.
33	4	$9 90	$13 35	$14 90	$18 35
	5	11 45	15 90	16 45	20 90
	6	13 00	16 45	18 00	21 45
	7	14 30	17 90	20 30	23 90
	8	15 60	19 35	21 60	25 35
	9	17 00	20 90	23 00	26 90
	10	18 40	22 45	24 40	28 45
	12	21 50	26 45	30 00	34 95
	14	24 90	30 35	33 40	38 85
	16	28 80	34 50	40 30	46 00
	18	32 90	39 00	44 40	50 50
	20	38 40	45 00	49 90	56 50
34	4	10 40	14 00	15 40	19 00
	5	12 05	15 65	17 05	20 65
	6	13 70	17 30	18 70	22 30
	7	15 00	18 60	21 00	24 60
	8	16 30	20 25	22 30	26 25
	9	17 80	21 40	23 80	27 40
	10	19 30	23 50	25 30	29 50
	12	22 40	27 55	30 90	36 05
	14	25 90	31 65	34 40	40 15
	16	29 90	35 90	41 40	47 40
	18	34 20	40 55	45 70	52 05
	20	39 80	46 75	51 30	58 25
35	4	10 90	14 65	15 90	19 65
	5	12 65	16 40	17 65	21 40
	6	14 40	18 15	19 40	23 15
	7	15 80	19 70	21 80	25 70
	8	17 20	21 25	23 20	27 25
	9	18 70	22 70	24 70	28 70
	10	20 20	24 55	26 20	30 55
	12	23 40	28 65	31 90	37 15
	14	27 00	32 85	35 50	41 35
	16	31 10	37 40	42 60	48 90
	18	35 40	42 15	46 90	53 65
	20	41 20	48 55	52 70	60 05

Diameter in Inches.	Width of Face.	WHOLE.		SPLIT.	
		Single Belt.	Double Belt.	Single Belt.	Double Belt.
36	4	$11 50	$15 45	$16 50	$20 45
	5	13 30	17 30	18 30	22 30
	6	15 10	19 05	20 10	24 05
	7	16 55	20 65	22 55	26 65
	8	18 00	22 20	24 00	28 20
	9	19 55	23 95	25 55	29 95
	10	21 10	25 65	27 10	31 65
	12	24 40	29 80	32 90	38 30
	14	28 00	34 00	36 50	42 50
	16	32 20	38 80	43 70	50 30
	18	36 80	44 00	48 30	55 50
	20	42 70	50 50	54 20	62 00
37	6	15 90	20 00	23 90	28 00
	8	18 90	23 40	26 90	31 40
	10	22 00	26 65	30 00	34 65
	12	25 40	31 10	37 40	43 10
	14	29 20	35 50	41 20	47 50
	16	33 40	40 30	49 40	56 30
	18	38 10	45 60	54 10	61 60
	20	44 10	52 20	60 10	68 20
38	6	16 70	20 90	24 70	28 90
	8	19 70	24 50	27 70	32 50
	10	22 80	28 20	30 80	36 20
	12	26 50	32 50	38 50	44 50
	14	30 30	36 90	42 30	48 90
	16	34 60	41 80	50 60	57 80
	18	39 40	47 20	55 40	63 20
	20	45 70	54 10	61 70	70 10
39	6	17 70	22 20	25 70	30 20
	8	20 80	25 90	28 80	33 90
	10	23 80	29 50	31 80	37 50
	12	27 60	34 00	39 60	46 00
	14	31 50	38 60	43 50	50 60
	16	35 80	43 30	51 80	59 30
	18	40 80	48 90	56 80	64 90
	20	47 20	55 90	63 20	71 90

Diameter in Inches.	Width of Face.	WHOLE.		SPLIT.	
		Single Belt.	Double Belt.	Single Belt.	Double Belt.
40	6	$18 60	$23 40	$26 60	$31 40
	8	21 80	27 20	29 80	35 20
	10	24 80	30 80	32 80	38 80
	12	28 80	35 50	40 80	47 50
	14	32 70	40 00	44 70	52 00
	16	37 10	45 00	53 10	61 00
	18	42 30	50 70	58 30	66 70
	20	49 00	58 00	65 00	74 00
41	6	19 40	24 50	27 40	32 50
	8	22 80	28 50	30 80	36 50
	10	25 80	32 10	33 80	40 10
	12	29 90	37 00	41 90	49 00
	14	33 90	41 75	45 90	53 75
	16	38 30	46 40	54 30	62 40
	18	43 70	52 40	59 70	68 40
	20	50 40	59 70	66 40	75 70
42	6	20 30	25 70	28 30	33 70
	8	23 90	29 90	31 90	37 90
	10	26 90	33 50	34 90	41 50
	12	31 10	38 60	43 10	50 60
	14	35 00	43 20	47 00	55 20
	16	39 70	48 10	55 70	64 10
	18	45 30	54 30	61 30	70 30
	20	52 00	61 60	68 00	77 60
43	6	21 30	27 00	29 30	35 00
	8	25 00	31 30	33 00	39 30
	10	28 00	34 90	36 00	42 90
	12	32 20	40 00	44 20	52 00
	14	36 30	44 70	48 30	56 70
	16	41 10	50 00	57 10	66 00
	18	46 90	56 40	62 90	72 40
	20	53 90	64 00	69 90	80 00

HOW TO ORDER PULLEYS, PAGE 51. EXTRA CHARGES, PAGE 51.

FINISHED PULLEYS—Continued.

Bored, Turned, Balanced, with Keyways or Set Screws.

Diameter in Inches.	Width of Face.	WHOLE.		SPLIT.	
		Single Belt.	Double Belt.	Single Belt.	Double Belt.
44	6	$22 20	$28 20	$30 20	$36 20
	8	26 10	32 70	34 10	40 70
	10	29 30	36 50	37 30	44 50
	12	33 40	41 50	45 40	53 50
	14	37 60	46 40	49 60	58 40
	16	42 60	52 00	58 60	68 00
	18	48 50	58 40	64 50	74 40
	20	55 70	66 25	71 70	82 25
45	6	23 10	29 40	31 10	37 40
	8	27 20	34 10	35 20	42 10
	10	30 40	37 90	38 40	45 90
	12	34 40	42 80	46 40	54 80
	14	39 00	48 20	51 00	60 20
	16	44 10	54 00	60 10	70 00
	18	50 20	60 60	66 20	76 60
	20	57 60	68 60	73 60	84 60
46	6	24 20	30 80	32 20	38 80
	8	28 20	35 40	36 20	43 40
	10	31 60	39 40	39 60	47 40
	12	35 60	44 40	47 60	56 40
	14	40 30	49 90	52 30	61 90
	16	45 80	56 00	61 80	72 00
	18	51 90	62 70	67 90	78 70
	20	59 30	70 70	75 30	86 70
47	6	25 20	32 10	33 20	40 10
	8	29 30	36 80	37 30	44 80
	10	32 80	40 90	40 80	48 90
	12	36 70	45 60	48 70	57 60
	14	41 70	51 50	53 70	63 50
	16	47 40	58 00	63 40	74 00
	18	53 70	65 00	69 70	81 00
	20	61 10	72 80	77 10	88 80

Diameter in Inches.	Width of Face.	WHOLE.		SPLIT.	
		Single Belt.	Double Belt.	Single. Belt.	Double Belt.
48	6	$26 20	$33 40	$38 70	$45 90
	8	30 40	38 20	42 90	50 70
	10	34 00	42 40	46 50	54 90
	12	38 00	47 00	54 50	63 50
	14	43 20	53 20	59 70	69 70
	16	49 00	60 20	71 50	82 70
	18	55 50	67 30	78 00	89 80
	20	62 90	74 90	85 40	97 40
	22	73 00	91 00	103 00	121 00
	24	81 50	105 50	111 50	135 50
49	6	27 20	34 70	39 70	47 20
	8	31 60	39 70	44 10	52 20
	10	35 20	43 90	47 70	56 40
	12	39 30	48 80	55 80	65 30
	14	44 70	55 00	61 20	71 50
	16	50 60	62 20	73 10	84 70
	18	57 20	69 50	79 70	92 00
	20	65 00	77 80	87 50	100 30
	22	75 00	93 50	105 00	123 50
	24	83 90	108 40	113 90	138 40
50	6	28 20	36 00	40 70	48 50
	8	32 70	41 10	45 20	53 60
	10	36 40	45 40	48 90	57 90
	12	40 50	50 40	57 00	66 90
	14	46 20	56 80	62 70	73 30
	16	52 00	64 00	74 50	86 50
	18	58 90	71 80	81 40	94 30
	20	66 90	80 50	89 40	103 00
	22	77 00	96 00	107 00	126 00
	24	86 30	111 30	116 30	141 30
51	6	29 30	37 40	41 80	49 90
	8	33 90	42 60	46 40	55 10
	10	37 70	47 00	50 20	59 50
	12	42 00	52 00	58 50	68 50
	14	47 80	58 60	64 30	75 10
	16	53 70	66 00	76 20	88 50
	18	60 80	74 00	83 30	96 50
	20	69 00	82 80	91 50	105 30
	22	79 00	98 40	109 00	128 40
	24	88 80	114 20	118 80	144 20

Diameter in Inches.	Width of Face.	WHOLE.		SPLIT.	
		Single Belt.	Double Belt.	Single Belt.	Double Belt.
52	6	$30 40	$38 80	$42 90	$51 30
	8	35 10	44 10	47 60	56 60
	10	39 00	48 60	51 50	61 10
	12	43 30	53 60	59 80	70 10
	14	49 30	60 50	65 80	77 00
	16	55 30	67 90	77 80	90 40
	18	62 40	76 00	84 90	98 50
	20	71 30	85 50	93 80	108 00
	22	81 00	100 80	111 00	130 80
	24	91 00	116 90	121 00	146 90
53	6	31 50	40 20	44 00	52 70
	8	36 30	45 60	48 40	58 10
	10	40 20	50 00	52 70	62 50
	12	44 80	55 40	61 30	71 90
	14	50 80	62 30	67 30	78 80
	16	56 90	69 80	79 40	92 30
	18	64 20	78 00	86 70	100 50
	20	73 20	87 50	95 70	110 00
	22	83 00	104 00	113 00	134 00
	24	93 60	120 00	123 60	150 00
54	6	32 60	41 60	45 10	54 10
	8	37 50	47 10	50 00	59 60
	10	41 50	51 70	54 00	64 20
	12	46 30	57 20	62 80	73 70
	14	52 40	64 20	68 90	80 70
	16	58 60	71 80	81 10	94 30
	18	66 00	80 00	88 50	102 50
	20	75 50	89 90	98 00	112 40
	22	85 00	105 70	115 00	135 70
	24	96 00	122 80	126 00	152 80
55	6	33 70	43 00	46 20	55 50
	8	38 70	48 60	51 20	61 10
	10	42 80	53 30	55 30	65 80
	12	47 80	59 00	64 30	75 50
	14	54 00	66 00	70 50	82 50
	16	60 60	74 10	83 10	96 60
	18	68 00	82 50	90 50	105 00
	20	77 70	92 70	100 20	115 20
	22	87 50	108 70	117 50	138 70
	24	98 40	125 70	128 40	155 70

Diameter in Inches.	Width of Face.	WHOLE.		SPLIT.	
		Single Belt.	Double Belt.	Single Belt.	Double Belt.
56	6	$34 80	$44 40	$47 30	$56 90
	8	39 90	50 10	52 40	62 60
	10	44 00	54 80	56 50	67 30
	12	49 30	60 80	65 80	77 30
	14	55 50	67 80	72 00	84 30
	16	62 70	76 50	85 20	99 00
	18	70 00	84 80	92 50	107 30
	20	79 90	95 50	102 40	118 00
	22	90 00	111 60	120 00	141 60
	24	101 00	129 00	131 00	159 00
57	6	36 00	45 90	48 50	58 40
	8	41 00	51 50	53 50	64 00
	10	45 30	56 40	57 80	68 90
	12	50 80	62 60	67 30	79 10
	14	57 00	69 50	73 50	86 00
	16	64 50	78 90	87 00	101 40
	18	72 10	87 30	94 60	109 80
	20	82 00	97 90	104 50	120 40
	22	92 40	114 30	122 40	144 30
	24	103 80	132 20	133 80	162 20
58	6	37 20	47 40	49 70	59 90
	8	42 30	53 10	54 80	65 60
	10	46 70	58 10	59 20	70 60
	12	52 30	64 40	68 80	80 90
	14	58 80	71 40	75 30	87 90
	16	66 50	81 50	89 00	104 00
	18	74 40	90 00	96 90	112 50
	20	84 30	100 50	106 80	122 00
	22	95 00	117 20	125 00	147 20
	24	106 70	135 50	136 70	165 50
59	6	38 40	48 90	50 90	61 40
	8	43 50	54 60	56 00	67 10
	10	48 10	59 80	60 60	72 30
	12	53 80	66 20	70 30	82 70
	14	60 40	73 30	76 90	89 80
	16	68 40	83 70	90 90	106 20
	18	76 60	92 50	99 10	115 00
	20	86 50	103 00	109 00	125 50
	22	97 50	120 00	127 50	150 00
	24	110 00	138 40	140 00	168 40

HOW TO ORDER PULLEYS, PAGE 51. EXTRA CHARGES, PAGE 51.

JAMES BEGGS & CO., No. 9 DEY STREET, NEW YORK.

FINISHED PULLEYS—Continued.

Bored, Turned, Balanced, with Keyways or Set Screws.

Diameter in Inches.	Width of Face.	WHOLE. Single Belt.	WHOLE. Double Belt.	SPLIT. Single Belt.	SPLIT. Double Belt.
60	6	$39 50	$50 30	$52 00	$62 80
	8	44 80	56 20	57 30	68 70
	10	49 50	61 50	62 00	74 00
	12	55 30	67 90	71 80	84 40
	14	62 00	75 20	78 50	91 70
	16	70 30	85 90	92 80	108 40
	18	78 80	95 00	101 30	117 50
	20	88 90	105 70	111 40	128 20
	22	100 00	122 80	130 00	152 80
	24	111 80	141 50	141 80	171 50
	26	120 00	162 60	150 00	192 60
	28	141 00	184 20	171 00	214 20
	30	157 00	207 10	187 00	237 10
61	6	40 70	51 80	58 70	69 80
	8	46 00	57 70	64 00	75 70
	10	50 80	63 10	68 80	81 10
	12	56 80	69 70	80 30	93 20
	14	63 50	77 00	87 00	100 50
	16	72 00	87 90	103 50	119 40
	18	80 70	97 20	112 20	128 70
	20	90 90	108 00	122 40	139 50
	22	102 30	125 70	145 30	168 70
	24	114 20	144 60	157 20	187 60
	26	128 50	165 70	171 50	208 70
	28	143 50	187 60	186 50	230 60
	30	159 70	210 70	202 70	253 70
62	6	42 00	53 40	60 00	71 40
	8	47 30	59 30	65 30	77 30
	10	52 10	64 70	70 10	82 70
	12	58 30	71 50	81 80	95 00
	14	65 20	79 00	88 70	102 50
	16	74 00	90 20	105 50	121 70
	18	82 90	99 70	114 40	131 20
	20	93 20	110 60	124 70	142 10
	22	104 70	128 70	147 70	171 70
	24	117 00	148 00	160 00	191 00
	26	131 50	169 00	174 50	212 00
	28	146 70	191 40	189 70	234 40
	30	163 00	214 60	206 00	257 60
63	6	$43 20	$54 90	$61 20	$72 90
	8	48 60	60 90	66 60	78 90
	10	53 50	66 40	71 50	84 40
	12	59 80	73 30	83 30	96 80
	14	66 80	80 90	90 30	104 40
	16	75 90	92 40	107 40	123 90
	18	85 10	102 20	116 60	133 70
	20	95 40	113 10	126 90	144 60
	22	107 00	131 30	150 00	174 30
	24	119 40	150 80	162 40	193 80
	26	134 00	172 10	177 00	215 10
	28	140 50	194 80	183 50	237 80
	30	165 70	217 90	208 70	260 90
64	6	44 50	56 50	62 50	74 50
	8	50 00	62 60	68 00	80 60
	10	54 90	68 10	72 90	86 10
	12	61 40	75 20	84 90	98 70
	14	68 40	82 80	91 90	106 30
	16	77 80	94 60	109 30	126 10
	18	87 30	104 70	118 80	136 20
	20	97 80	115 80	129 30	147 30
	22	109 60	134 20	152 60	177 20
	24	122 20	154 00	165 20	197 00
	26	137 00	175 70	180 00	218 70
	28	152 40	198 30	195 40	241 30
	30	169 00	222 10	212 00	265 10
65	6	45 80	58 10	63 80	76 10
	8	51 40	64 30	69 40	82 30
	10	56 30	69 80	74 30	87 80
	12	63 00	77 10	86 50	100 60
	14	70 20	84 90	93 70	108 40
	16	79 80	96 90	111 30	128 40
	18	89 50	107 20	121 00	138 70
	20	100 00	118 30	131 50	149 80
	22	112 00	137 00	155 00	180 00
	24	124 90	157 20	167 90	200 20
	26	139 50	178 80	182 50	221 80
	28	155 10	201 60	198 10	244 60
	30	172 00	225 40	215 00	268 40
66	6	$47 10	$59 70	$65 10	$77 70
	8	52 80	66 00	70 80	84 00
	10	57 80	71 60	75 80	89 60
	12	64 00	79 00	87 50	102 50
	14	72 00	87 00	95 50	110 50
	16	81 60	99 00	113 10	130 50
	18	91 80	109 80	123 30	141 30
	20	102 30	120 90	133 80	152 40
	22	114 60	140 00	157 60	183 00
	24	127 40	160 00	170 40	203 00
	26	142 00	181 90	185 00	224 90
	28	157 90	205 00	200 90	248 00
	30	175 00	229 30	218 00	272 30
67	6	48 40	61 30	66 40	79 30
	8	54 10	67 60	72 10	85 60
	10	59 20	73 30	77 20	91 30
	12	66 30	81 00	89 80	104 50
	14	73 60	88 90	97 10	112 40
	16	83 50	101 20	115 00	132 70
	18	93 90	112 20	125 40	143 70
	20	104 50	123 40	136 00	154 90
	22	116 80	142 80	159 80	185 80
	24	130 00	163 20	173 00	206 20
	26	145 00	185 50	188 00	228 50
	28	160 80	208 50	203 80	251 50
	30	178 00	232 90	221 00	275 90
68	6	49 70	62 90	67 70	80 90
	8	55 40	69 20	73 40	87 20
	10	60 60	75 00	78 60	93 00
	12	68 00	83 00	91 50	106 50
	14	75 40	91 00	98 90	114 50
	16	85 60	103 60	117 10	135 10
	18	96 10	114 70	127 60	146 20
	20	107 00	126 20	138 50	157 70
	22	119 60	146 00	162 60	189 00
	24	132 80	166 40	175 80	209 40
	26	148 00	189 10	191 00	232 10
	28	164 00	212 30	207 00	255 30
	30	181 00	236 80	224 00	279 80
69	6	$51 00	$64 50	$69 00	$82 50
	8	56 70	70 80	74 70	88 80
	10	62 00	76 70	80 00	94 70
	12	69 50	84 80	93 00	108 30
	14	77 30	93 20	100 80	116 70
	16	87 70	106 00	119 20	137 50
	18	98 50	117 40	130 00	148 90
	20	109 30	128 80	140 80	160 30
	22	122 50	149 20	165 50	192 20
	24	135 50	169 50	178 50	212 50
	26	150 50	191 90	193 50	234 90
	28	166 70	215 60	209 70	258 60
	30	184 00	240 40	227 00	283 40
70	6	52 40	66 20	70 40	84 20
	8	58 10	72 50	76 10	90 50
	10	63 40	78 40	81 40	96 40
	12	71 10	86 70	94 60	110 20
	14	79 20	95 40	102 70	118 90
	16	89 80	108 40	121 30	139 90
	18	100 70	119 90	132 20	151 40
	20	112 00	131 80	143 50	163 30
	22	125 00	152 30	168 00	195 30
	24	138 20	172 80	181 20	215 80
	26	153 50	195 50	196 50	238 50
	28	169 80	219 30	212 80	262 30
	30	187 00	244 00	230 00	287 00
71	6	53 80	67 90	71 80	85 90
	8	59 40	74 10	77 40	92 10
	10	64 80	80 10	82 80	98 10
	12	72 60	88 50	96 10	112 00
	14	80 90	97 40	104 40	120 90
	16	91 80	110 70	123 30	142 20
	18	102 80	122 30	134 30	153 80
	20	114 30	134 40	145 80	165 90
	22	127 40	155 00	170 40	198 00
	24	140 70	175 70	183 70	218 70
	26	156 00	198 60	199 00	241 60
	28	172 40	222 50	215 40	265 50
	30	189 80	247 40	232 80	290 40

HOW TO ORDER PULLEYS, PAGE 51. EXTRA CHARGES, PAGE 51.

FINISHED PULLEYS.—Continued.

Bored, Turned, Balanced, with Keyways or Set Screws.

Diameter in Inches.	Width of Face.	WHOLE.		SPLIT.	
		Single Belt.	Double Belt.	Single Belt.	Double Belt.
72	6	$55 30	$69 70	$73 30	$87 70
	8	60 80	75 80	78 80	93 80
	10	66 20	81 80	84 20	99 80
	12	74 20	90 40	97 70	113 90
	14	82 80	99 60	106 30	123 10
	16	93 90	113 10	125 40	144 60
	18	105 00	124 80	136 50	156 30
	20	117 00	137 40	148 50	168 90
	22	129 90	157 80	172 90	200 80
	24	143 30	178 70	186 30	221 70
	26	158 80	202 00	201 80	245 00
	28	175 20	225 90	218 20	268 90
	30	192 70	251 20	235 70	294 20
75	10	71 20	87 40	80 20	105 40
	12	79 50	96 30	103 00	119 80
	14	88 30	105 70	111 80	129 20
	16	99 90	119 70	131 40	151 20
	18	111 50	131 90	143 00	163 40
	20	124 40	145 40	155 90	176 90
	22	137 70	166 50	180 70	209 50
	24	151 50	188 00	194 50	231 00
	26	167 20	211 90	210 20	254 90
	28	184 00	236 50	227 00	279 50
	30	202 00	262 60	245 00	305 60
76	10	73 10	89 90	91 10	107 90
	12	81 40	98 80	104 90	122 30
	14	90 50	108 50	114 00	132 00
	16	102 00	122 40	133 50	153 90
	18	113 70	134 70	145 20	166 20
	20	126 90	148 50	158 40	180 00
	22	140 10	169 80	183 10	212 80
	24	153 90	191 50	196 90	234 50
	26	169 70	215 00	212 70	258 00
	28	186 50	239 60	229 50	282 60
	30	204 50	265 50	247 50	308 50

Diameter in Inches.	Width of Face.	WHOLE.		SPLIT.	
		Single Belt.	Double Belt.	Single Belt.	Double Belt.
78	10	$76 60	$94 00	$94 60	$112 00
	12	85 50	103 50	109 00	127 00
	14	94 70	113 30	118 20	136 80
	16	106 40	128 00	137 90	159 50
	18	118 00	140 20	149 50	171 70
	20	132 00	154 80	163 50	186 30
	22	145 50	176 10	188 50	219 10
	24	159 40	197 80	202 40	240 80
	26	175 40	221 90	218 40	264 90
	28	192 50	247 10	235 50	290 10
	30	210 60	273 30	253 60	316 30
84	10	89 10	108 90	107 10	126 90
	12	98 00	118 40	121 50	141 90
	14	108 00	129 00	131 50	152 50
	16	120 50	143 90	152 00	175 40
	18	133 00	157 00	164 50	188 50
	20	146 80	171 40	178 30	202 90
	22	160 80	193 80	203 80	236 80
	24	175 40	216 80	218 40	259 80
	26	192 00	241 80	235 00	284 80
	28	209 80	268 00	252 80	311 00
	30	226 50	293 40	269 50	336 40
90	10	102 50	123 50	137 50	158 50
	12	112 40	134 00	147 40	169 00
	14	122 80	145 60	157 80	180 60
	16	135 70	160 90	183 70	208 90
	18	148 00	173 80	196 00	221 80
	20	162 30	188 70	210 30	236 70
	22	177 00	212 70	240 00	275 70
	24	192 00	236 40	255 00	299 40
	26	208 00	261 10	271 00	324 10
	28	225 60	287 40	288 60	350 40
	30	243 50	314 30	306 50	377 30

Diameter in Inches.	Width of Face.	WHOLE.		SPLIT.	
		Single Belt.	Double Belt.	Single Belt.	Double Belt.
96	12	.....	$149 60	.....	$184 60
	14	.....	161 60	.....	196 60
	16	.....	177 60	.....	225 60
	18	.....	192 00	.....	240 00
	20	.....	208 80	.....	256 00
	22	.....	232 00	.....	295 00
	24	.....	256 00	.....	319 00
	26	.....	282 40	.....	345 40
	28	.....	312 00	.....	375 00
	30	.....	336 00	.....	399 00
102	12	.....	165 60	.....	200 60
	14	.....	178 40	.....	213 40
	16	.....	195 20	.....	243 20
	18	.....	208 80	.....	256 80
	20	.....	228 80	.....	276 80
	22	.....	252 00	.....	315 00
	24	.....	277 60	.....	340 60
	26	.....	304 00	.....	367 00
	28	.....	334 40	.....	397 40
	30	.....	360 00	.....	423 00
108	12	.....	181 60	.....	216 60
	14	.....	195 20	.....	230 20
	16	.....	213 60	.....	261 60
	18	.....	228 00	.....	276 00
	20	.....	249 60	.....	297 60
	22	.....	272 00	.....	335 00
	24	.....	299 20	.....	362 20
	26	.....	325 60	.....	388 60
	28	.....	356 80	.....	419 80
	30	.....	385 60	.....	448 60

Diameter in Inches.	Width of Face.	WHOLE.		SPLIT.	
		Single Belt.	Double Belt.	Single Belt.	Double Belt.
114	12	.....	$197 60	.....	$232 60
	14	.....	212 80	.....	247 80
	16	.....	232 00	.....	280 00
	18	.....	248 00	.....	296 00
	20	.....	271 20	.....	319 20
	22	.....	294 40	.....	357 40
	24	.....	320 80	.....	383 80
	26	.....	348 00	.....	411 00
	28	.....	380 00	.....	443 00
	30	.....	412 00	.....	475 00
120	12	.....	214 40	.....	249 40
	14	.....	230 40	.....	265 40
	16	.....	250 40	.....	298 40
	18	.....	268 00	.....	316 00
	20	.....	293 60	.....	341 60
	22	.....	316 00	.....	379 00
	24	.....	343 20	.....	406 20
	26	.....	371 20	.....	434 20
	28	.....	404 00	.....	467 00
	30	.....	439 20	.....	502 20

HOW TO ORDER PULLEYS, PAGE 51. EXTRA CHARGES, PAGE 51.

JAMES BEGGS & CO., No. 9 DEY STREET, NEW YORK.

Additional Price to be added to List Price for each Loose Pulley.

Diameter in Inches.	Price.	Diameter in Inches.	Price.	Diameter in Inches.	Price.
6 to 8	$1 50	23 to 24	$4 00	41 to 44	$7 00
9 to 10	1 75	25 to 26	4 30	45 to 48	7 75
11 to 12	2 00	27 to 28	4 60	49 to 52	8 40
13 to 14	2 35	29 to 30	5 00	53 to 56	9 00
15 to 16	2 70	31 to 32	5 30	57 to 60	9 70
17 to 18	3 00	33 to 34	5 60	61 to 66	10 50
19 to 20	3 35	35 to 36	6 00	67 to 72	11 50
21 to 22	3 70	37 to 40	6 50		

Loose Pulleys should have hubs of ample length.

The hubs on a pair of loose and tight pulleys should meet so as to keep the rims slightly apart.

If you want a loose pulley to run with a tight pulley which you already have, tell us whether the hub on your tight pulley is even with the face, or whether it recedes from or projects beyond it, and how much.

In some cases, in making a pair of loose and tight pulleys, it is desirable to make the loose an inch or so smaller in diameter than the tight; a flange will facilitate the shifting of the belt. This takes the excessive strain off of the belt while it is doing no work, thus saving power and prolonging the life of the belt.

To obtain the list on flanged loose pulleys, take the list on an ordinary pulley, add the extra charge as given above, and the price of one flange as given in next table.

We can furnish any style of self-lubricating device for loose pulleys.

Additional Price to be added to List Price for Flanged Pulleys.

Diameter in Inches.	Price Each Flange.	Diameter in Inches.	Price Each Flange.	Diameter in Inches.	Price Each Flange.
6 to 8	$2 00	23 to 24	$5 00	41 to 44	$11 80
9 to 10	2 30	25 to 26	5 50	45 to 48	13 35
11 to 12	2 60	27 to 28	6 20	49 to 52	15 00
13 to 14	2 85	29 to 30	7 00	53 to 56	16 30
15 to 16	3 25	31 to 32	7 70	57 to 60	18 30
17 to 18	3 60	33 to 34	8 40	61 to 66	20 80
19 to 20	4 00	35 to 36	9 20	67 to 72	23 25
21 to 22	4 50	37 to 40	10 40		

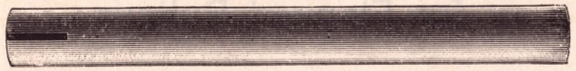
Pulleys made with one, two or three flanges as desired.

Additional Price to be added to List Price for Clamp Hub Pulleys.

Diameter.	Face.	Price.	Diameter.	Face.	Price.	Diameter.	Face.	Price.
6 to 12	3 to 4	$0 85	24 to 30	4 to 6	$2 50	48 to 60	6 to 10	$7 50
	5 to 6	1 00		7 to 10	3 00		11 to 14	10 00
	7 to 10	1 20		11 to 14	4 00		15 to 20	13 50
	11 to 14	1 50		15 to 20	5 40		21 to 30	18 00
13 to 18	3 to 4	90	31 to 36	4 to 6	3 00	61 to 84	6 to 10	10 80
	5 to 6	1 20		7 to 10	3 60		11 to 14	14 00
	7 to 10	1 50		11 to 14	5 00		15 to 20	19 00
	11 to 16	2 10		15 to 20	7 00		21 to 30	25 80
19 to 23	3 to 4	1 60	37 to 47	6 to 10	5 00	85 to 120	10 to 14	21 00
	5 to 6	2 00		11 to 14	7 50		15 to 20	28 80
	7 to 10	2 40		15 to 20	10 00		21 to 30	37 80
	11 to 14	3 00					31 to 40	48 00
	15 to 20	4 00						

A Clamp Hub Pulley can be fastened firmly at any place upon the shaft. The fastening or "grip" comprises the entire length of the hub and is very secure. Pulleys secured in this manner seldom or never become loose and are very easily removed.

SHAFTING.



PRICE LIST.

Diameter.	Price per Foot.	Net Price per foot for all Keyseats other than for Couplings furnished.	Net Price for each Journal or Shoulder.	Diameter.	Price per Foot.	Net Price per foot for all Keyseats other than for Couplings furnished.	Net Price for each Journal or Shoulder.
$1\frac{5}{16}$	$0 50	$0 25	$0 50	$2\frac{5}{16}$	$1 90	$0 70	$1 40
$1\frac{3}{16}$	55	30	55	$3\frac{3}{16}$	2 20	75	1 50
$1\frac{7}{16}$	70	40	70	$3\frac{7}{16}$	2 90	80	1 65
$1\frac{11}{16}$	85	45	85	$3\frac{15}{16}$	3 70	90	1 75
$1\frac{15}{16}$	95	50	95	$4\frac{7}{16}$	5 40	1 00	2 00
$2\frac{3}{16}$	1 10	55	1 00	$4\frac{15}{16}$	7 20	1 25	2 25
$2\frac{7}{16}$	1 40	60	1 10	$5\frac{3}{8}$	9 00	1 50	2 50
$2\frac{11}{16}$	1 65	65	1 25	$5\frac{7}{8}$	11 00	2 00	3 00

HORSE-POWER LINE SHAFTING.

WILL TRANSMIT WITH SAFETY.

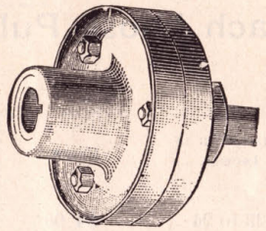
With Bearings 8 to 10 Feet Centres.

Size Shaft.	Horse-Power in one Rev.	Size Shaft.	Horse-Power in one Rev.	Size Shaft.	Horse-Power in one Rev.	Size Shaft.	Horse-Power in one Rev.
$1\frac{5}{16}$	.008	$2\frac{7}{16}$	.125	$3\frac{15}{16}$	0.512	$6\frac{15}{16}$	2.744
$1\frac{3}{16}$	.016	$2\frac{11}{16}$	.166	$4\frac{7}{16}$	0.728	$7\frac{7}{16}$	3.368
$1\frac{7}{16}$	.027	$2\frac{15}{16}$	.216	$4\frac{15}{16}$	1.000	$7\frac{15}{16}$	4.096
$1\frac{11}{16}$	.043	$3\frac{3}{16}$	.272	$5\frac{7}{16}$	1.328	$8\frac{7}{16}$	4 912
$1\frac{15}{16}$	.064	$3\frac{7}{16}$	.343	$5\frac{15}{16}$	1.728	$8\frac{15}{16}$	5.824
$2\frac{3}{16}$	.091	$3\frac{11}{16}$	.424	$6\frac{7}{16}$	2.195	$9\frac{7}{16}$	6.848

For Jack Shafts or main section of line shafts allow only three-fourths of the horse-power given above, and also provide extra bearings wherever heavy strains occur, as with main belts or gears.

To find the horse-power of a shaft at any number of revolutions, multiply the number of revolutions desired by the horse-power of the shaft at one revolution as given in table.

FLANGE COUPLINGS.



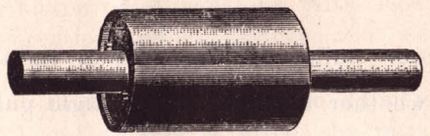
This coupling is very strong and is generally used for heavy shafting.

We follow the best practice, which is, that the coupling should be turned off on the shaft after it has been securely fastened with tapered keys.

PRICES PER PAIR, FITTED.

$1\frac{7}{16}$	$1\frac{11}{16}$	$1\frac{15}{16}$	$2\frac{3}{16}$	$2\frac{7}{16}$	$2\frac{11}{16}$	$2\frac{15}{16}$	$3\frac{3}{16}$	$3\frac{7}{16}$	$3\frac{15}{16}$	$4\frac{7}{16}$	$4\frac{15}{16}$	$5\frac{3}{8}$	$5\frac{7}{8}$
$7 25	$7 50	$9 00	$10 50	$12 50	$15 50	$18 50	$22 00	$25 00	$32 50	$42 00	$53 50	$63 50	$77 00

CLAMP COUPLINGS.



There are only three parts to this coupling.

Very quickly and easily applied or removed.

Being strongly made throughout, and of ample length in proportion to diameter of shaft, it is very powerful, and will safely transmit all the power that the shaft is capable of transmitting. Each coupling keyseated and furnished with key.

While it is well to have both shafts keyseated, this is not absolutely necessary, because the body of the coupling and the method of fastening secure perfect alignment and a grip the entire length of the coupling. It will be seen, therefore, that for extending a shaft which is in use this is the most convenient form of coupling.

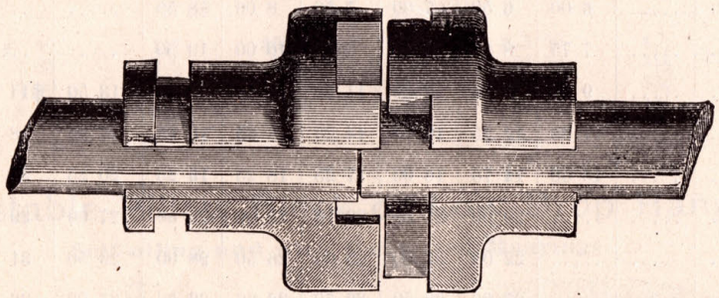
PRICES.

$1\frac{5}{16}$	$1\frac{3}{16}$	$1\frac{7}{16}$	$1\frac{11}{16}$	$1\frac{15}{16}$	$2\frac{3}{16}$	$2\frac{7}{16}$	$2\frac{11}{16}$	$2\frac{15}{16}$	$3\frac{3}{16}$	$3\frac{7}{16}$	$3\frac{15}{16}$	$4\frac{7}{16}$	$4\frac{15}{16}$	$5\frac{3}{8}$	$5\frac{7}{8}$
$5 20	$5 40	$5 75	$6 50	$8 25	$10 00	$12 00									

REDUCTION COUPLINGS.

We furnish these in either Flange or Clamp style for connecting shafts of different diameters. Prices the same as those of ordinary couplings for the larger size shaft.

JAW CLUTCH COUPLINGS.



FINISHED ALL OVER.

PRICE LIST.

Size of Shaft.	Price per Pair.		Size of Shaft.	Price per Pair.	
	Fitted.	Not Fitted.		Fitted.	Not Fitted.
$1\frac{3}{16}$	$10 00	$7 00	$2\frac{7}{16}$	$18 75	$14 25
$1\frac{7}{16}$	12 00	8 00	$2\frac{11}{16}$	23 25	18 50
$1\frac{11}{16}$	12 75	8 50	$2\frac{15}{16}$	27 75	22 75
$1\frac{15}{16}$	13 50	9 00	$3\frac{7}{16}$	37 50	30 00
$2\frac{3}{16}$	15 75	11 25	$3\frac{15}{16}$	48 75	39 00

Shifting Gear Furnished to Order.

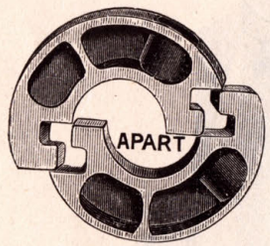
COLLARS.

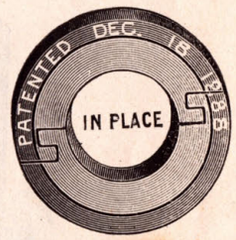
Finished All Over. Case Hardened Set Screws.

PRICE LIST.

Size Shaft.	Price Each.	Size Shaft.	Price Each.	Size Shaft.	Price Each.	Size Shaft.	Price Each.
$\frac{15}{16}$	$0 60	$1\frac{15}{16}$	$1 60	$2\frac{15}{16}$	$3 00	$4\frac{7}{16}$	$5 60
$1\frac{3}{16}$	80	$2\frac{3}{16}$	1 90	$3\frac{3}{16}$	3 25	$4\frac{15}{16}$	7 00
$1\frac{7}{16}$	1 00	$2\frac{7}{16}$	2 40	$3\frac{7}{16}$	3 50	$5\frac{3}{8}$	7 60
$1\frac{11}{16}$	1 25	$2\frac{11}{16}$	2 70	$3\frac{15}{16}$	4 60	$5\frac{7}{8}$	9 20

PATENT SAFETY SPLIT COLLARS.

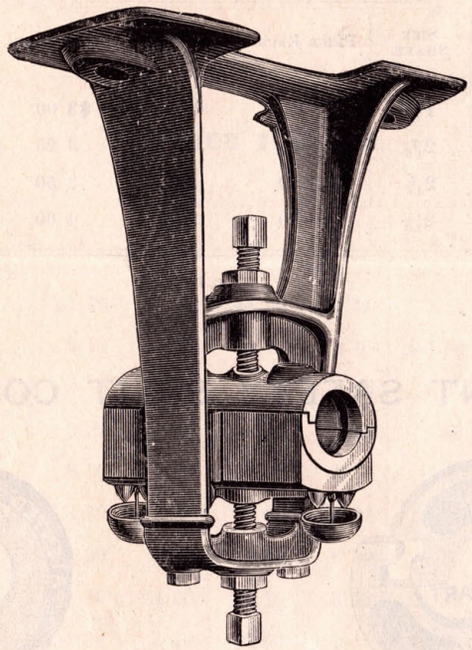




The above cuts represent our Patent Safety Split Collars, which in many cases will be found very convenient, as they can be put on the shaft without taking it down or taking off pulleys and couplings. These collars are made light and strong and bored to any size; also neatly polished.

Size Shaft.	Price Each.	Size Shaft.	Price Each.	Size Shaft.	Price Each.	Size Shaft.	Price Each.
$\frac{15}{16}$	$0 95	$1\frac{15}{16}$	$2 10	$2\frac{15}{16}$	$3 60	$4\frac{7}{16}$	$7 05
$1\frac{3}{16}$	1 20	$2\frac{3}{16}$	2 40	$3\frac{3}{16}$	4 05	$4\frac{15}{16}$	8 85
$1\frac{7}{16}$	1 50	$2\frac{7}{16}$	2 70	$3\frac{7}{16}$	4 50	$5\frac{3}{8}$	10 05
$1\frac{11}{16}$	1 80	$2\frac{11}{16}$	3 15	$3\frac{15}{16}$	5 40	$5\frac{7}{8}$	12 65

DOUBLE BRACED ADJUSTABLE HANGERS AND FLOOR STANDS.



These have long self-oiling boxes lined with a good quality of Babbitt Metal.

They are very carefully proportioned in regard to diameter, drop, spread, etc.

PRICE LIST.

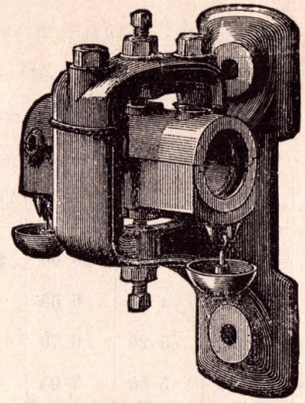
Size Shaft	Drop in Inches from Centre of Box to Bottom of Base.										
	6	7½	9	12	15	18	21	24	27	30	36
15/16	$2 25	$2 50	$2 75	$3 50	$4 00	.. .	.....	.....	.....	.....	.....
1 3/16	3 00	3 25	3 50	4 00	4 25	.....	....	.....	.....	.....	.....
1 7/16	3 75	4 00	4 25	4 50	4 75	$5 00	$5 25	.....	.....	.....	.....
1 11/16	.....	.....	5 00	5 25	5 50	5 75	6 00	.....	.....	.....	.....
1 15/16	....	....	6 00	6 50	7 00	7 50	8 00	$8 50	.....	.....	.....
2 3/16	.....	.....	7 75	8 25	9 00	9 50	10 00	10 50	.....	.....	.....
2 7/16	....	.....	9 00	9 75	10 50	11 25	12 00	12 75	$13 50	$14 25	$15 75
2 11/16	. ...	.....	11 25	12 25	13 25	14 25	15 25	16 25	17 25	18 25	20 25
2 15/16	.....	.....	13 50	14 75	16 00	17 25	18 25	19 25	20 25	21 25	23 25
3 3/16	.....	.....	.....	20 00	21 50	22 75	24 00	25 50	27 00	29 00	30 50
3 7/16	.....	.....	.....	22 00	23 50	25 00	26 50	28 00	29 50	31 00	34 00
3 15/16	....	.....	.....	27 00	28 50	30 50	32 00	33 50	35 00	36 50	40 00
4 7/16	.....	.....	.....	.....	36 00	38 00	40 00	42 00	44 00	46 00	50 00
4 15/16	.....	.....	.....	.....	41 00	43 00	45 00	47 00	49 00	51 00	55 00
5 3/8	.....	.....	.....	.....	.....	.....	63 00	66 50	70 00	73 50	80 50
5 7/8	.....	.....	.....	. ...	.....	.....	70 00	74 00	78 00	82 00	90 00

Special Heavy Hangers and Stands for Main Shafts, Electrical Work, etc., made to order.

PRICES QUOTED ON APPLICATION.

ADJUSTABLE POST HANGER,

Self-oiling and with Babbitted Bearings.

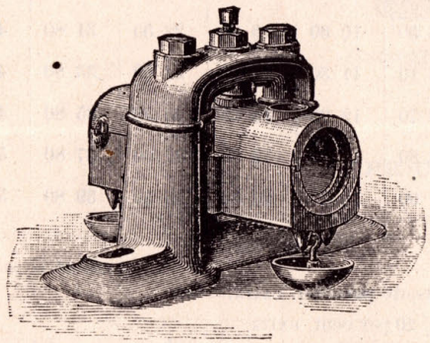


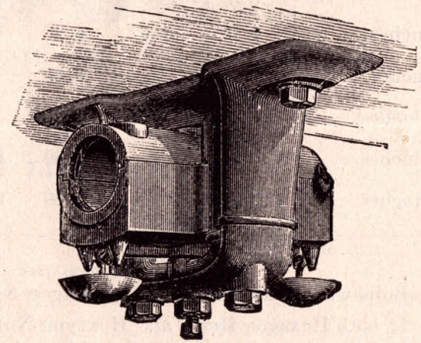
PRICE LIST.

Size.	Price.	Size.	Price.	Size.	Price.	Size.	Price.
15/16	$2 40	1 15/16	$5 50	2 15/16	$13 50	4 7/16	$42 50
1 3/16	2 85	2 3/16	7 25	3 3/16	16 50	4 15/16	52 00
1 7/16	4 00	2 7/16	8 75	3 7/16	19 50	5 3/8	68 00
1 11/16	4 75	2 11/16	11 75	3 15/16	30 00	5 7/8	77 00

Adjustable Pillow Block or Low Drop Hanger,

Self-oiling and with Babbitted Bearings.



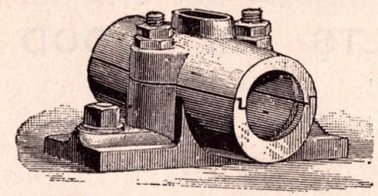


PRICE LIST.

Size.	Price.	Size.	Price.	Size.	Price.	Size.	Price.
15/16	$2 40	1 15/16	$5 00	2 15/16	$11 50	4 7/16	$33 50
1 3/16	2 85	2 3/16	6 50	3 3/16	14 00	4 15/16	43 00
1 7/16	3 80	2 7/16	8 00	3 7/16	17 00	5 3/8	52 00
1 11/16	4 25	2 11/16	9 75	3 15/16	24 50	5 7/8	65 00

RIGID PILLOW BLOCKS,

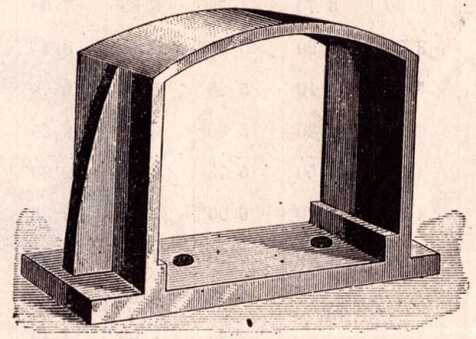
With Babbitted Bearings.



PRICE LIST.

Size.	Price.	Size.	Price.	Size.	Price.	Size.	Price.
15/16	$2 25	1 15/16	$5 00	2 15/16	$11 25	4 7/16	$28 75
1 3/16	2 75	2 3/16	6 25	3 3/16	13 00	4 15/16	36 50
1 7/16	3 25	2 7/16	7 50	3 7/16	16 00	5 3/8	44 75
1 11/16	3 75	2 11/16	9 00	3 15/16	20 00	5 7/8	55 75

WALL FRAMES.



These Frames can be fitted with either **Adjustable or Rigid Pillow Blocks.**

PRICE LIST.

Size Shaft.	Width Frame.	Price. Frame.	With Rigid Pillow Block.	With Adj. Pillow Block.	Size Shaft.	Width Frame.	Price. Frame.	With Rigid Pillow Block.	With Adj. Pillow Block.
15/16	4 inches	$4 00	$6 25	$6 40	2 15/16	8 inches	$10 50	$21 75	$22 00
1 3/16	4 "	4 25	7 00	7 10	3 3/16	8 "	13 00	26 00	27 00
1 7/16	5 "	4 50	7 75	8 30	3 7/16	9 "	14 00	30 00	31 00
1 11/16	5 "	4 75	8 50	9 00	3 15/16	9 "	20 00	40 00	44 50
1 15/16	6 "	5 50	10 50	10 50	4 7/16	10 "	30 00	58 75	63 50
2 3/16	6 "	6 00	12 25	12 50	4 15/16	12 "	40 00	76 50	83 00
2 7/16	7 "	7 00	14 50	15 00	5 3/8	14 "	45 00	89 75	97 00
2 11/16	7 "	8 00	17 00	17 75	5 7/8	16 "	50 00	105 75	115 00

Manufacturers' Price List

OF

LAG BOLTS OR WOOD SCREWS,

With Square Heads.

PRICE PER 100.

Length.	5/16	3/8	7/16	1/2	9/16 & 5/8	3/4	7/8	1
1½ inches	$2 70	$3 10	$4 00	$4 30	.....	.....	.....	.....
2 inches	2 90	3 30	4 25	4 65	$6 50	.....	.....	.....
2½ inches	3 10	3 50	4 50	5 00	7 05	$10 20	.....	.....
3 inches	3 30	3 70	4 75	5 35	7 60	10 95	$16 00	.....
3½ inches	3 50	3 90	5 00	5 70	8 15	11 70	17 00	$22 60
4 inches	3 70	4 10	5 25	6 05	8 70	12 45	18 00	24 00
4½ inches	3 90	4 30	5 50	6 40	9 25	13 20	19 00	25 40
5 inches	4 10	4 50	5 75	6 75	9 80	13 95	20 00	26 80
5½ inches	4 30	4 70	6 00	7 10	10 35	14 70	21 00	28 20
6 inches	4 50	4 90	6 25	7 50	10 90	15 50	22 00	29 60
7 inches	.....	.....	6 75	8 20	12 00	17 00	24 00	32 40
8 inches	.....	.....	7 25	8 90	13 10	18 50	26 00	35 20
9 inches	.....	.....	7 75	9 60	14 20	20 00	28 00	38 00
10 inches	.....	.....	.....	10 30	15 30	21 50	30 00	40 80
11 inches	.....	.....	.....	11 00	16 40	23 00	32 00	43 60
12 inches	.....	.....	.....	11 70	17 50	24 50	34 00	46 40

LUMBER.

We keep large stocks of Pine, Spruce, etc., and can furnish at lowest market prices.

Manufacturers' Price List of Machine Bolts,

With Square Heads and Nuts. Finished Points.

PRICE PER 100.

Length.	1/4	5/16	3/8	7/16	1/2	9/16 & 5/8	3/4	7/8	1
1½ inches	$2 80	$3 20	$3 60	$4 60	$6 00	$9 00	$12 70	$18 80	$27 50
2 inches	2 90	3 35	3 80	4 90	6 35	9 55	13 45	19 80	28 80
2½ inches	3 00	3 50	4 00	5 20	6 70	10 10	14 20	20 80	30 10
3 inches	3 10	3 65	4 20	5 50	7 05	10 65	14 95	21 80	31 40
3½ inches	3 20	3 80	4 40	5 80	7 40	11 20	15 70	22 80	32 70
4 inches	3 30	3 95	4 60	6 10	7 75	11 75	16 45	23 80	34 00
4½ inches	3 40	4 10	4 80	6 40	8 10	12 30	17 20	24 80	35 30
5 inches	3 50	4 25	5 00	6 70	8 45	12 85	17 95	25 80	36 60
5½ inches	3 60	4 40	5 20	7 00	8 80	13 40	18 70	26 80	37 90
6 inches	3 70	4 55	5 40	7 30	9 15	13 95	19 45	27 80	39 20
6½ inches	3 80	4 70	5 60	7 60	9 50	14 50	20 20	28 80	40 50
7 inches	3 90	4 85	5 80	7 90	9 85	15 05	20 95	29 80	41 80
7½ inches	4 00	5 00	6 00	8 20	10 20	15 60	21 70	30 80	43 10
8 inches	4 10	5 15	6 20	8 50	10 60	16 20	22 50	31 80	44 40
9 inches	.....	.....	6 60	9 10	11 30	17 30	24 00	33 80	47 00
10 inches	....	.....	7 00	9 70	12 00	18 40	25 50	35 80	49 60
11 inches	.....	.....	7 40	10 30	12 70	19 50	27 00	37 80	52 20
12 inches	.....	.....	7 80	10 90	13 40	20 60	28 50	39 80	54 80

Bolts with Hexagon Heads or Hexagon Nuts, 10 per cent. extra.
If both Hexagon Heads and Hexagon Nuts, 20 per cent. extra.
Bolts of any size made to order.

WASHERS.

Sold by weight. In millwright work use one washer for bolt head and one for nut.

JAMES BEGGS & CO., No. 9 DEY STREET, NEW YORK.

PRICE LIST OF LEATHER BELTING,

Per Running Foot.

1 inch	$0 10	13 inch	$1 68	36 inch	$5 70		
1½ "	17	14 "	1 82	38 "	6 05		
2 "	23	15 "	1 98	40 "	6 40		
2½ "	30	16 "	2 14	44 "	7 10		
3 "	36	17 "	2 31	48 "	7 80		
3½ "	43	18 "	2 49				
4 "	50	19 "	2 66				
4½ "	56	20 "	2 84				
5 "	63	21 "	3 02				
5½ "	70	22 "	3 20				
6 "	76	23 "	3 37				
7 "	90	24 "	3 54				
8 "	1 02	26 "	3 92				
9 "	1 15	28 "	4 30				
10 "	1 29	30 "	4 64				
11 "	1 42	32 "	5 00				
12 "	1 55	34 "	5 35				

ROUND BELTS.

SOLID.

⅛ inch	$0 05
3/16 "	07
¼ "	10
5/16 "	14
⅜ "	18

TWISTED.

⅛ inch	$0 06
3/16 "	10
¼ "	14
5/16 "	18
⅜ "	22
½ "	30
⅝ "	36
¾ "	46
⅞ "	60
1 "	72

DOUBLE BELTING TWICE THE PRICE OF SINGLE.

N. B.—In ordering state how Belts are to be run. We do not guarantee Belts run on quarter turn unless they are especially made for that purpose.

PRICE LIST OF RUBBER BELTING,

Per Running Foot.

	2-Ply.	3-Ply.	4-Ply.	5-Ply.	6-Ply.
1 inch	$0 07	....	....	...	....
1½ "	11	....	..	....	....
2 "	15	$0 17	$0 21	....	....
2½ "	18	22	26	....	....
3 "	22	26	31	....	....
3½ "	26	30	37	....	....
4 "	30	34	42	....	....
4½ "	33	39	47	....	....
5 "	36	43	52	....	....
6 "	43	52	62	....	....
7 "	51	60	73	....	...
8 "	59	70	84	$1 05	$1 26
9 "	67	80	95	1 18	1 42
10 "	75	90	1 07	1 33	1 60
11 "	83	1 00	1 18	1 47	1 77
12 "	91	1 08	1 30	1 62	1 95
13 "	1 00	1 18	1 42	1 77	2 13
14 "	1 08	1 28	1 54	1 92	2 31
15 "	1 16	1 38	1 66	2 07	2 49
16 "	1 25	1 50	1 78	2 22	2 67
18 "	1 41	1 70	2 02	2 52	3 03
20 "	1 58	1 90	2 26	2 82	3 39
22 "	1 76	2 12	2 52	3 15	3 78
24 "	1 96	2 36	2 80	3 50	4 20

HORSE-POWER OF BELTING.

A simple rule for ascertaining the transmitting power of belting, without first computing speed per minute that it travels, is as follows: Multiply diameter of pulley in inches by its number of revolutions per minute, and this product by width of the belt in inches; divide this product by 3,300 for single belting, and by 2,100 for double belting, and the quotient will be the amount of horse-power that can be safely transmitted.

TABLE

For Single Leather, Four-Ply Rubber and Four-Ply Cotton Belting.

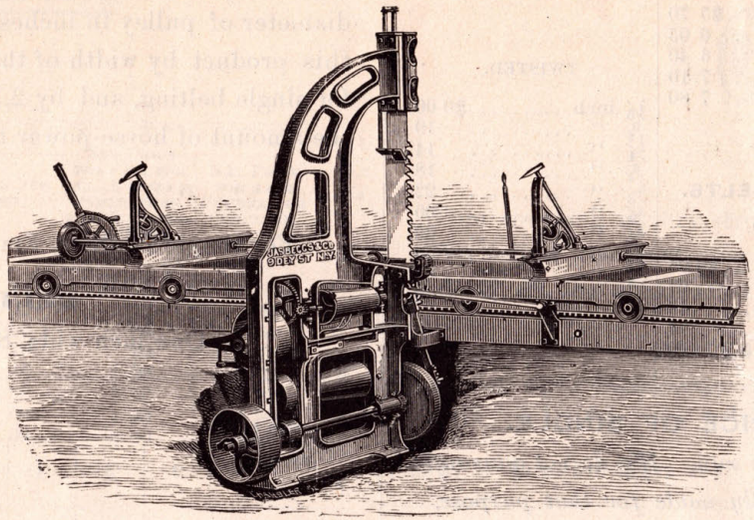
BELTS NOT OVERLOADED.

One inch wide, 800 feet per minute=one horse-power.

Speed in Feet per Minute.	Width of Belts in Inches.											
	2	3	4	5	6	8	10	12	14	16	18	20
	H. P.	H. P.	H. P.	H. P	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.
400	1	1½	2	2½	3	4	5	6	7	8	9	10
600	1½	2¼	3	3¾	4½	6	7½	9	10½	12	13½	15
800	2	3	4	5	6	8	10	12	14	16	18	20
1,000	2½	3¾	5	6¼	7½	10	12½	15	17½	20	22½	25
1,200	3	4½	6	7½	9	12	15	18	21	24	27	30
1,500	3¾	5¾	7½	9½	11½	15	18¾	22½	26½	30	33¾	37½
1,800	4½	6¾	9	11¼	13½	18	22½	27	31½	36	40½	45
2,000	5	7½	10	12½	15	20	25	30	35	40	45	50
2,400	6	9	12	15	18	24	30	36	42	48	54	60
2,800	7	10½	14	17½	21	28	35	42	49	56	63	70
3,000	7½	11¼	15	18¾	22½	30	37½	45	52½	60	67½	75
3,500	8¾	13	17½	22	26	35	44	52½	61	70	79	88
4,000	10	15	20	25	30	40	50	60	70	80	90	100
4,500	11¼	17	22½	28	34	45	57	69	78	90	102	114
5,000	12½	19	25	31	37½	50	62½	75	87½	100	112	125

Double Leather, Six-Ply Rubber or Six-Ply Cotton Belting will transmit 50 to 75 per cent. more power than is shown in this table. One inch wide, 550 feet per minute=one horse-power.

SIDE-CUTTING MULAY SAW MILL.



For moderate operations in lumbering our Side-Cutting Mulay Saw Mill still holds its supremacy. It has a larger compass of usefulness than any other mill, as it will cut all kinds of lumber—hard or soft, large or small—into any shape or dimensions, with less power than any other kind of mill. It has been improved, from time to time, as dictated by the results of our observation and experience, and we now present it with increased confidence. The main frame is made entirely of iron, and faced true to form bearings for the slides and other working parts. The crank-shaft runs in self-lubricating boxes, at a speed of about 500 revolutions per minute. The driving pulley is 20 inches in diameter and 7-inch face, but will be made larger or smaller to suit the speed of the motive power. The crank-pin is of steel and to this is fitted the pitman which gives motion to the saw. The lower end of the saw is attached to the pitman by means of a buckle and parallel rods in such a manner as to produce a vertical movement of the saw on its downward stroke, and give clearance to the teeth on the upward stroke. This is a very important and valuable feature, and is the key to our success in operating saws with light power, as it dispenses with the use of slides, keeps the saw in better alignment, admits of continuous feed, avoids the friction against the saw teeth on the upward stroke, carries the sawdust downward instead of retaining it in the throats of the teeth, and enables us to cut boards 34 inches wide with a 5-foot saw having only 16 inches stroke, without choking the saw with sawdust. The feed is driven by friction, and varied by tapering cones to cut from $\frac{1}{8}$ to $\frac{3}{8}$ inch at each stroke of the saw. The track furnished with the mill is fastened to the main frame in a manner that insures it to be at right angle with the crank-shaft, and of the proper height to suit the carriage and head-blocks. The carriage is in two sections, bolted together, and is long enough for 20-foot logs, of any diameter up to 4 feet. The corners of the carriage are protected with iron, and it is mounted on 8-inch track wheels whose axles extend from side to side of carriage. The head-blocks may be set any distance apart to suit different lengths of logs, and the knees moved simultaneously by a lever and pawls working into a ratchet wheel. Any thickness of board up to $1\frac{1}{2}$ inches may be set by one movement of this lever, and the graduated stop varies the thickness by sixteenths. In addition to the ordinary dog for driving into the top of the log, each knee has a screw dog which can be forced into the face of the log, or side of the plank, and prevent it from being drawn from the knees or thrown upward by the saw.

The capacity of the mill is varied by the manner it is handled, and by the size and character of the logs to be cut. With the usual size thresher engine of 10 horse-power, and medium-sized oak logs, 1,800 to 3,000 feet per day would be an average; while in poplar logs of good size double that quantity could be reached.

Each mill is supplied with a saw, feed belt, oil can, saw-set, upset, file, crowbar, monkey wrench, two small wrenches, two cant-hooks, two lumber clamps, and two off-bearing rollers. Price, $700.

JAMES BEGGS & CO., No. 9 DEY STREET, NEW YORK.

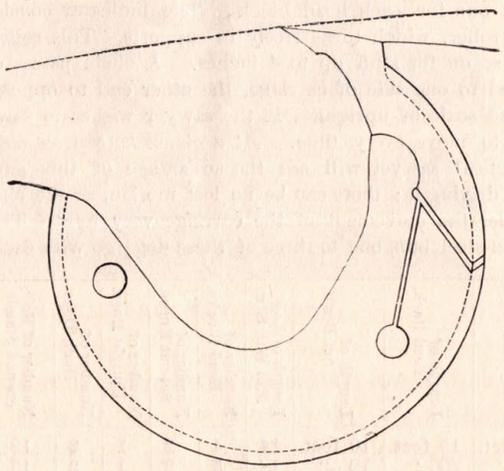
CELEBRATED PATENT CHISEL-TOOTH SAWS.

JAMES BEGGS & CO., No. 9 DEY STREET, NEW YORK.

Our Chisel-Tooth Saws have, by reason of their superior mechanical arrangement and excellence of workmanship, won the confidence of mill men. Over 20,000 are now in operation throughout the United States, and are being generally used in foreign countries. They require less power, make better lumber, and produce it at less cost than any other saw. We are daily receiving testimonials in their favor. The saws are furnished ready to put on the mandrel, and any person of ordinary ability can insert the bits when required.

They are made from 13 to 5 gauge, and from ten to seventy-two inches in diameter. The illustration shows one of the three sizes of sockets and teeth employed. The No. 2 Tooth is used for edges and is just what is required for gangs; the teeth being so readily changed, the saws need never be taken from the mandrel. The No. 3 Tooth, as shown below, is generally used for hard wood, and is the best saw where all-around work is to be done, also for frozen timber. The No. 4 Tooth, still larger than the No. 3, having more throat room, is designed for the soft and pitchy timber of southern and tropical countries.

Our Round Socket, by means of which the tooth is firmly fixed in the saw blade without rivets or keys, receives its finishing accompaniment in the Rotary Locking Shank, by which the cutting bit is seized, carried into the socket, and held in a positive position. This device is so strong and simple in construction, so reliable and expeditious, that at each insertion of a new set of bits, our Chisel-Tooth Saw is in a much better condition than it is possible for an expert sawyer to put a solid saw by dressing it in any of the ordinary ways.



No. 3. FULL SIZE.

The Chisel Bits are forged into such perfect shape that they do not break when cutting knots, and cut iron or stone at one-twentieth the cost and damage occasioned to a solid tooth saw. A large circular, it is true, in cutting a nail or stone, seldom dulls more than half a dozen teeth; but it must be cut down, rounded, and all the teeth swaged out and filed to an edge; so that it would not be safe to estimate the reduction of the saw, expense of files, labor, and loss of time at less than five dollars, while it would cost our improved saw, at the most, only half a dozen new bits, worth, say, eighteen cents.

Diameter in Inches.	No. 2 TEETH.				Size of Mandrel Holes.	No. 3 TEETH.				No. 4 TEETH.				Size of Mandrel Holes.	No. of Bits given with each Saw.	No. of extra Shanks given with each Saw.
	Gauge at Rim.	No. of Teeth in Saw.	Price.	Greatest No. of Teeth that can be put in a Saw.		Gauge at Rim.	No. of Teeth in Saw.	Price.	Greatest No. of Teeth that can be put in a Saw.	Gauge at Rim.	No. of Teeth in Saw.	Price.	Greatest No. of Teeth that can be put in a Saw.			
12	13 to 8 Gauge inclusive.	12	**$15 00**	12	1	11 to 6 Gauge inclusive.	..	.....	..	9 to 6 Gauge inclusive.	..	.....	..	..	...	..
14		14	**17 00**	14	$1\frac{1}{8}$		..	.....	..		..	.....	..	..	...	..
16		16	**20 00**	16	$1\frac{1}{8}$		12	**$20 00**	12		..	.....	..	$1\frac{1}{8}$	100	2
18		18	**23 00**	18	$1\frac{1}{4}$		12	**23 00**	14		..	.....	..	$1\frac{1}{4}$	100	2
20		20	**27 00**	20	$1\frac{5}{16}$		12	**26 00**	16		..	.....	..	$1\frac{5}{16}$	100	2
22		20	**31 00**	24	$1\frac{5}{16}$		12	**29 00**	16		12	**$29 00**	12	$1\frac{5}{16}$	200	2
24		20	**35 00**	26	$1\frac{3}{8}$		12	**32 00**	18		12	**32 00**	14	$1\frac{3}{8}$	200	2
26		24	**40 00**	28	$1\frac{3}{8}$		14	**36 00**	20		12	**36 00**	14	$1\frac{3}{8}$	200	2
28		24	**45 00**	30	$1\frac{1}{2}$		14	**40 00**	22		14	**40 00**	16	$1\frac{1}{2}$	200	2
30		28	**50 00**	32	$1\frac{1}{2}$		16	**45 00**	24		14	**45 00**	18	$1\frac{1}{2}$	200	2
32		28	**55 00**	34	$1\frac{5}{8}$		16	**50 00**	26		16	**50 00**	20	$1\frac{5}{8}$	300	3
34		32	**60 00**	36	$1\frac{5}{8}$		20	**55 00**	26		16	**55 00**	22	$1\frac{5}{8}$	300	3
36		32	**65 00**	38	$1\frac{5}{8}$		20	**60 00**	28		18	**60 00**	22	$1\frac{5}{8}$	300	3
38		34	**70 00**	42	$1\frac{5}{8}$		24	**65 00**	30		20	**65 00**	24	$1\frac{5}{8}$	300	3
40		34	**75 00**	44	2		24	**70 00**	32		20	**70 00**	26	2	300	3
42	..	..	.....	..	2		28	**80 00**	34		24	**80 00**	28	2	400	4
44	..	..	.....	..	2		28	**90 00**	36		24	**90 00**	30	2	400	4
46	..	..	.....	..	2	..	32	**100 00**	38		26	**100 00**	30	2	400	4
48	..	..	.....	..	2	..	32	**110 00**	38		26	**110 00**	52	2	400	4
50	..	..	.....	..	2	..	36	**122 00**	40	..	28	**122 00**	34	2	400	4
52	..	..	.....	.	2	..	36	**140 00**	42	..	28	**140 00**	36	2	500	5
54	..	..	.....	..	2	..	40	**160 00**	44	..	32	**160 00**	38	2	500	5
56	..	..	.....	..	2	..	40	**180 00**	44	..	32	**180 00**	38	2	500	5
58	..	..	.....	..	2	..	44	**210 00**	46	..	36	**210 00**	40	2	500	5
60	..	..	.....	..	2	..	44	**240 00**	48	..	36	**240 00**	42	2	500	5
62	..	..	.....	..	2	.	46	**275 00**	50	..	38	**275 00**	44	2	500	5
64	..	..	.....	..	2	..	48	**310 00**	52	..	38	**310 00**	46	2	500	5
66	..	..	.....	..	2	..	48	**350 00**	54	..	40	**350 00**	48	2	500	5
68	..	..	.....	..	2	..	52	**400 00**	58	..	40	**400 00**	50	2	500	5
70	..	..	.....	..	2	..	54	**450 00**	60	.	44	**450 00**	52	2	500	5
72	..	..	.....	..	2	..	56	**500 00**	62	..	44	**500 00**	54	2	500	5

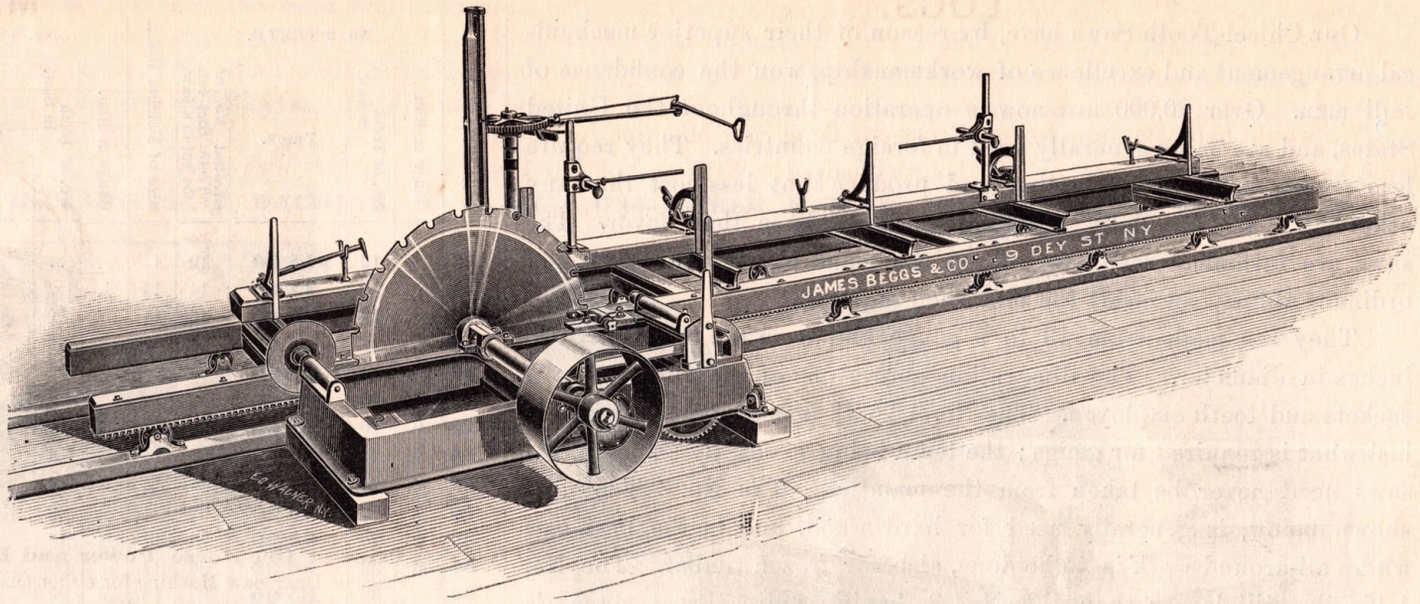
The Chisel-Tooth Saw is delivered in perfect order, ready to put on the mandrel, with a supply of bits. That they may be conveniently handled, and also to avoid the possibility of their being damaged in transit, no bits are inserted in the plates at our works, but are all carefully packed in strong wooden boxes, and, together with a wrench, placed in the case with the saw for shipment.

SPECIAL FILES FOR CHISEL-TOOTH SAWS.

Per Dozen..... $4 00.

PATENT PLANTATION "JUNIOR" LEVER-SET CIRCULAR-SAW MILL.

DESCRIPTION.

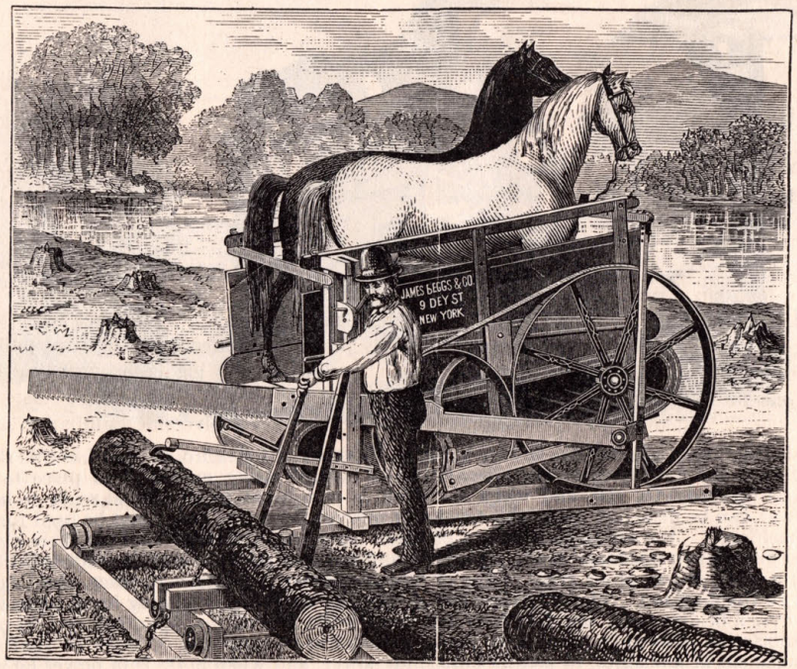


The carriage has head blocks its whole length at intervals of four or five feet; two or more of them are set head blocks, with teeth on the side. Each set head block is provided with a slide casting, to which is secured the log beam fitted to a planed gib, and extends down the side of head block, forming a bearing for lower end of pinion shaft. Another casting on top of this forms a bearing for top of pinion shaft, and keeps the sliding rack in position. The sliding racks have a lug on the end, through which passes a rod with a nut on each side of lug. Each set head block has a pinion with teeth of sufficient length to engage with teeth on head blocks below and with sliding rack above. Now, if one of these pinions is moved, the same motion is imparted to the other pinion through the sliding racks, and as both pinions engage with teeth on head blocks the log is propelled forward, each end moving at the same time and exactly the same distance. There are twelve teeth in each pinion, of one-inch pitch. One revolution of pinion moves the log beam one foot; one-twelfth moves it one inch. The teeth on pinions and racks are heavily shrouded and are turned and planed to pitch line, which makes them work very smoothly. The pinion on the head block nearest the saw has a long shaft passing up through a column which is secured to slide casting. On the top end of shaft is a ratchet wheel and under this wheel is a lever for setting the log. The set lever is provided with a double pawl, which engages the teeth of ratchet wheel, and by throwing one end of pawl in gear a forward motion to log beam is made, and by throwing other end in gear a backward motion is produced. This pawl is operated by a twist in pull handle by means of a rod connecting pawl with an arm in handle. There are two sets of teeth on ratchet wheel; one set of fine teeth on the under side to prevent log beam springing back by means of a weighted pawl. The log beam is provided with knees and set-outs for sawing tapering stuff, one for each head block. The indicator consists of a wooden upright fastened to a log beam, the front side being divided in inches, halves, quarters, etc. On the side of upright is a wood roller, which turns freely in supports. This roller has twelve sides similar to a lumber measure. The first side has divisions for ½-inch boards—allowing for saw cut—the next ¾ boards, and so on for stuff up to 4 inches. A chain passes over a pulley near the top of upright; the ends pass down either side through log beam, around pulleys underneath, one end of chain being fixed to one side of carriage, the other end to opposite side; and index is put on chain at proper place. When the log beam is moved, motion is given to the index, which slides along the roller and scale of upright. If the sawyer wishes to saw inch boards, after turning the square side of log to knees he turns the roller around to division for inch stuff; this tells him just how far to move every time. *At a glance he can see not only the number of inches between saw and knees, but the number of inch boards the log will make and the same for any other size stuff.* Any practical sawyer will see the advantage of this gauge over a weighted chain or a wheel with divisions, which cannot be depended upon for accuracy on account of the slack in the mechanism for driving it; there can be no lost motion, as the chain is stretched tight and any motion of the log beam is precisely indicated by the pointer. The carriage travels on anti-friction rollers, which render the movement of the carriage very light. These rollers run in a groove on the log side. Beside the ordinary hook dogs used on all our mills, we furnish a self-adjusting upright dog with cast-steel bits, one to three of these dogs go with each mill, depending on length of carriage. The husk is of iron, cast in one solid piece with heavy ribs at top and bottom. The feed works is operated by a friction pulley inside the rim of driving pulley. Contact with a pulley on arbor drives carriage forward; gig back by bringing friction pulley in contact with inside of rim of driving pulley. The shifting of friction pulley is effected by an eccentric box, operated by a lever. In the feed works a detachable chain belt is substituted for belts, and works on cone sprocket wheels, giving three changes of feed. In the place of pivoted boxes we have solid or stiff boxes bolted to the top of husk, and for adjusting lead the whole frame is turned by the adjusting screw shown on corner of frame; the frame or husk turning on a pivot or trunnion in the middle of frame. This does away with all the objections so common with pivot boxes. We think the advantage of this arrangement for lead adjustment will be appreciated by all, as the frame revolving on pivot requires much less movement than with the plan usually used. The screw being at corner of frame, adjustment can be made while the saw is in motion. The saw guide is made of steel with brass adjusting nut, and saw can be changed without removing guide. The arbor is steel, 2½ inches in diameter, driving pulley 24x10 inches. Husk is made to take 40 to 56 inch saw. The carriage is made of selected spruce of liberal dimensions strongly bolted together. The set beam is made of Georgia pine 4x10. The set works are substantial and reliable, and as a setting device have no superior.

Length of Carriage.	Length of Feed Rack.	Length of Set-Beam.	Length of Log Mill Will Saw.	Number of Head Blocks.	Number of Set-out Knees.	Number of Upright Dogs.	Number of Hook Dogs.	Number of Rollers and Stands.	Greatest distance between Saw and Knees.	Size of Driving Pulley.	Shipping Weight in Pounds, about.	Price, complete, without Saw.
12 feet.	15 feet.	10 feet.	14	4	2	1	2	12	32 inch.	24x10	1,800	$316 00
15 "	20 "	12 "	18	5	2	1	2	15	32 "	24x10	2,000	336 00
20 "	25 "	17 "	24	5	2	2	2	20	32 "	24x10	2,300	377 00
25 "	30 "	22 "	28	6	3	2	2	25	32 "	24x10	2.500	424 00
30 "	35 "	27 "	33	7	3	2	3	30	32 "	24x10	2,700	469 00
35 "	40 "	32 "	38	8	3	2	3	35	32 "	24x10	3,000	499 00
40 "	45 "	37 "	43	9	4	3	3	40	32 "	24x10	3,200	530 00
45 "	50 "	40 "	48	10	4	3	3	45	32 "	24x10	3,500	561 00
50 "	55 "	42 "	53	11	4	3	3	50	32 "	24x10	3,600	591 00
55 "	60 "	45 "	58	12	4	4	3	55	32 "	24x10	3,800	632 00
60 "	65 "	48 "	63	12	5	4	3	60	32 "	24x10	4,000	662 00

DRAG SAWS AND MACHINES FOR SAWING LOGS.

We would call attention to our Cross-cut Drag Saw Machine for sawing large logs into stove length or any length desired. With one of our Drag Saw Machines and our Two-Horse Power, there can be cut from hard maple logs from forty to fifty cords of stove wood per day, and about two-thirds as much with our One-Horse Power.

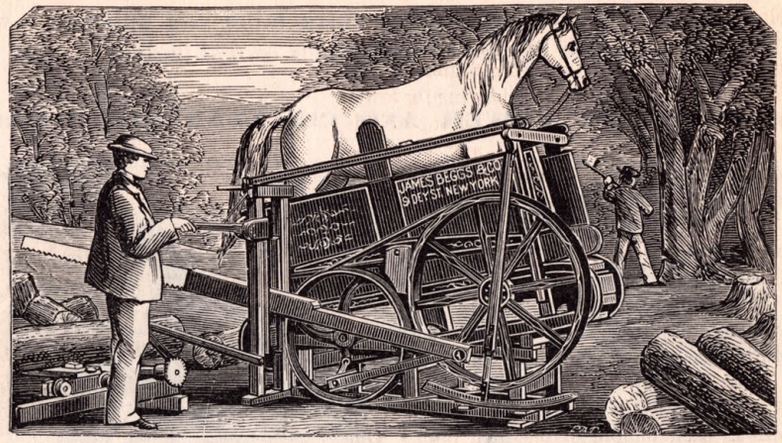


TWO-HORSE POWER WITH DRAG SAW MACHINE.

You will see by the cut that our Drag Saw Machines are run by belt from band wheel of power to balance wheel of Drag Saw Machine, thus increasing the speed of the stroke of the saw, and enabling a larger amount of work to be performed in a given time than would be possible if the saw were attached directly to the band wheel of the power, as is the case with some other machines. This arrangement also removes the strain of the jerking motion of the saw almost entirely from the power.

Price of Two-Horse Power. with Drag Saw Machine, complete with belt, $

ONE-HORSE POWER WITH DRAG SAW MACHINE.

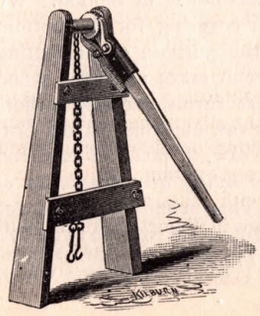


Price of One-Horse Power and Drag Saw Machine, complete with belt, $
Price of Drag Saw Machine for either One or Two Horse Power, with belt, . .
Price of Belt for Drag Saw Machine, ...

In ordering Drag Saw Machines be very particular to give length of lags in power they are wanted to fit.

Many of our patrons already have the Horse Powers, which they use for threshing, and to those we would especially recommend our Wood Sawing Attachments, as it will put them in the way to earn many a dollar during the winter season, when they would perhaps otherwise be idle, and this at a very small outlay. Where parties already have the power and Thresher, they will need no extra belt for the Circular Saw, as it can be run by the same belt that is used to run the Thresher ; but with the Drag Saw Machine the belt is shorter, and it would be advisable to get a belt especially for it, rather than cut the long threshing belt.

A JACK FOR RAISING AND LOWERING POWERS.



RATCHET LEVER JACK.

PRICE, $

This is a very convenient and simple arrangement for saving many a lift. With one of these it is a very easy matter to raise up the end of the mounted power, slip off the wheels and then lower the axle down to the ground, thus setting up your machine without any lifting. It can also be used with powers which are not mounted ; for instance, in raising the front to put under the feet.

CIRCULAR SAWS.

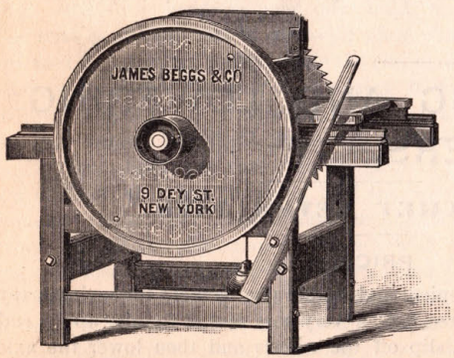
We are satisfied that our Circular Saw Machines are the most simple, durable and most easily managed of any in the market. You will see by the testimonials in our circular (which are but a few of the large number which have been sent to us voluntarily) that our Circular Saw Machine with our Two-Horse Power is capable of sawing from 18 to 24 cords of four-foot wood twice in two per day; with One-Horse Power about two-thirds as much. We can furnish at small additional expense an extra table and splitting saw for splitting boards. We also furnish a cheap shingle saw and attachments to fit our regular frame, to enable parties to make their own shingles.

OUR ONE-HORSE POWER AND CIRCULAR SAW MACHINE.

Our One-Horse Power and Circular Saw are serviceable machines, and are very extensively used. They will cut from eight to twelve cords of four-foot wood twice in two, in a day, with an ordinary weight horse.

Price of One-Horse Power and 24-inch Circular Saw Machine, complete, with 28 feet of three-and-a-half inch rubber belting, oilers, wrenches, etc., . . $

WOOD CIRCULAR SAW MACHINES



Are made with a large web balance wheel, as less liable to produce accidents than an armed wheel. The slides the table moves on are so arranged as to render it impossible to displace the table when the machine is in motion. We have recently added a covering for the bottom part of the saw, for the purpose of preventing accidents to the man who takes away the wood from the saw. We are furnishing steel arbors for all our saws. Our saw machines have a cast-steel collar to hold the saw, in place of cast-iron as heretofore, thus *obviating any possibility of the collars bursting.* This machine is used for sawing four-foot wood once and twice in two. We believe this is the best Circular Saw Machine manufactured. Weight, 375 lbs.

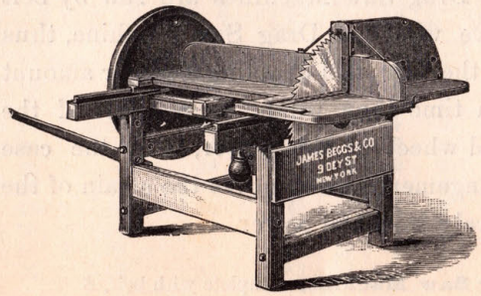
Price, with 24-inch Saw, ... $

OUR ONE-HORSE POWER AND CIRCULAR SAW MACHINE COMBINED WITH TRUCKS.

This machine is adapted for sawing wood in villages and for railroads, and has this advantage over a Power and Saw Machine made separately—it is more easily moved from place to place, is always set up ready for use, and when the work is completed is all loaded ready to be moved. The power can be detached from the trucks by unscrewing a few bolts, and be used for running other machinery. We sell large numbers of these machines, and those that use them claim them to be far superior to machines made separately and not combined, as it is all made together and is more firm when in use, and a great saving of time in moving from place to place, and in getting to work with the machine. The only time lost in starting machine is leading horse from thills into power, over a bridge some ten feet long by three wide (which the manufacturers do not make, as transportation costs more than the bridge). It requires no removing of bolts or shafts, or any disarrangement of machines, in getting horse into power, and when horse is in power he will work just as well as if power was on the ground in place of on wheels. Whole weight, 1,600 pounds.

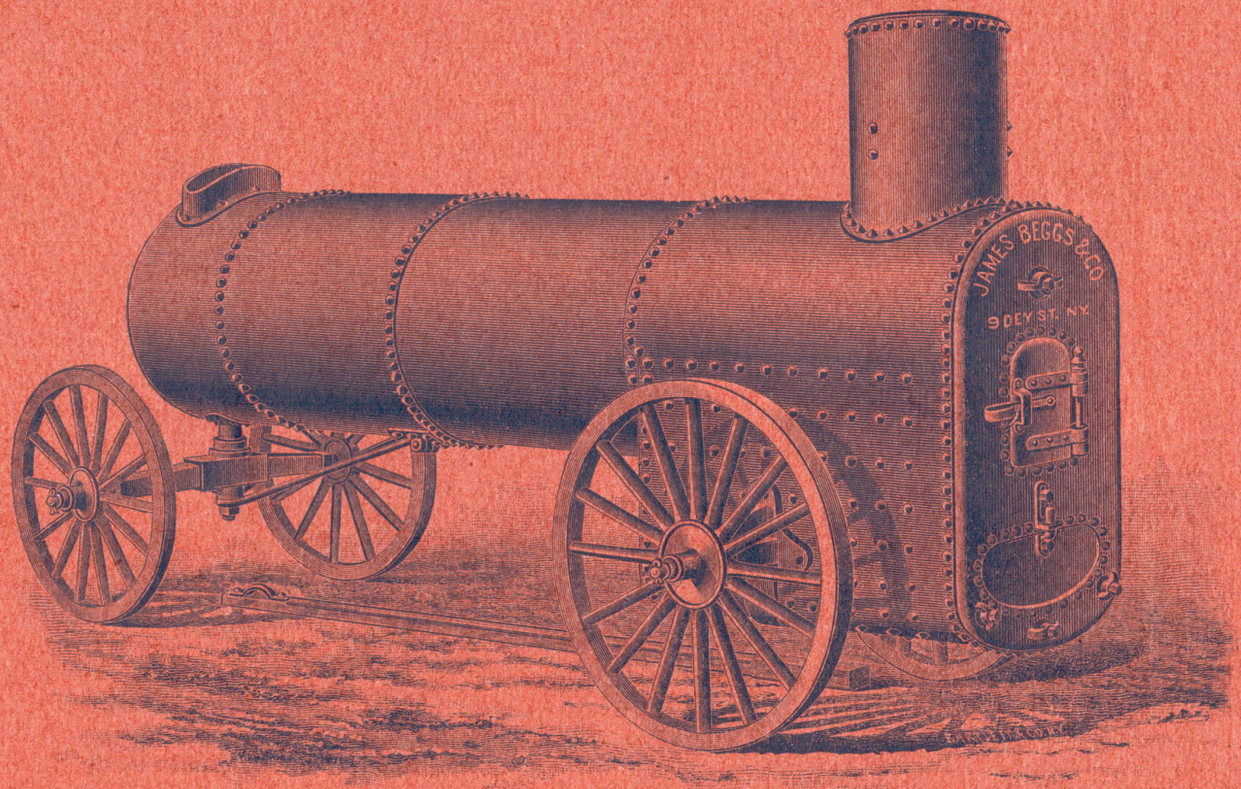
Price of One-Horse Power and Circular Saw Combined, with trucks and belt, $

WOOD CIRCULAR SAW MACHINES WITH EXTENDED TABLE



Are made with a table both sides of the saw, which is better adapted for sawing long wood and can be used for sawing four-foot wood into stove wood. Saw machines made in this way can be used by one person sawing, as there is a rest for the wood both sides of the saw, which very often is convenient when there are but a few cords of wood to be sawed and only one person to do the sawing.

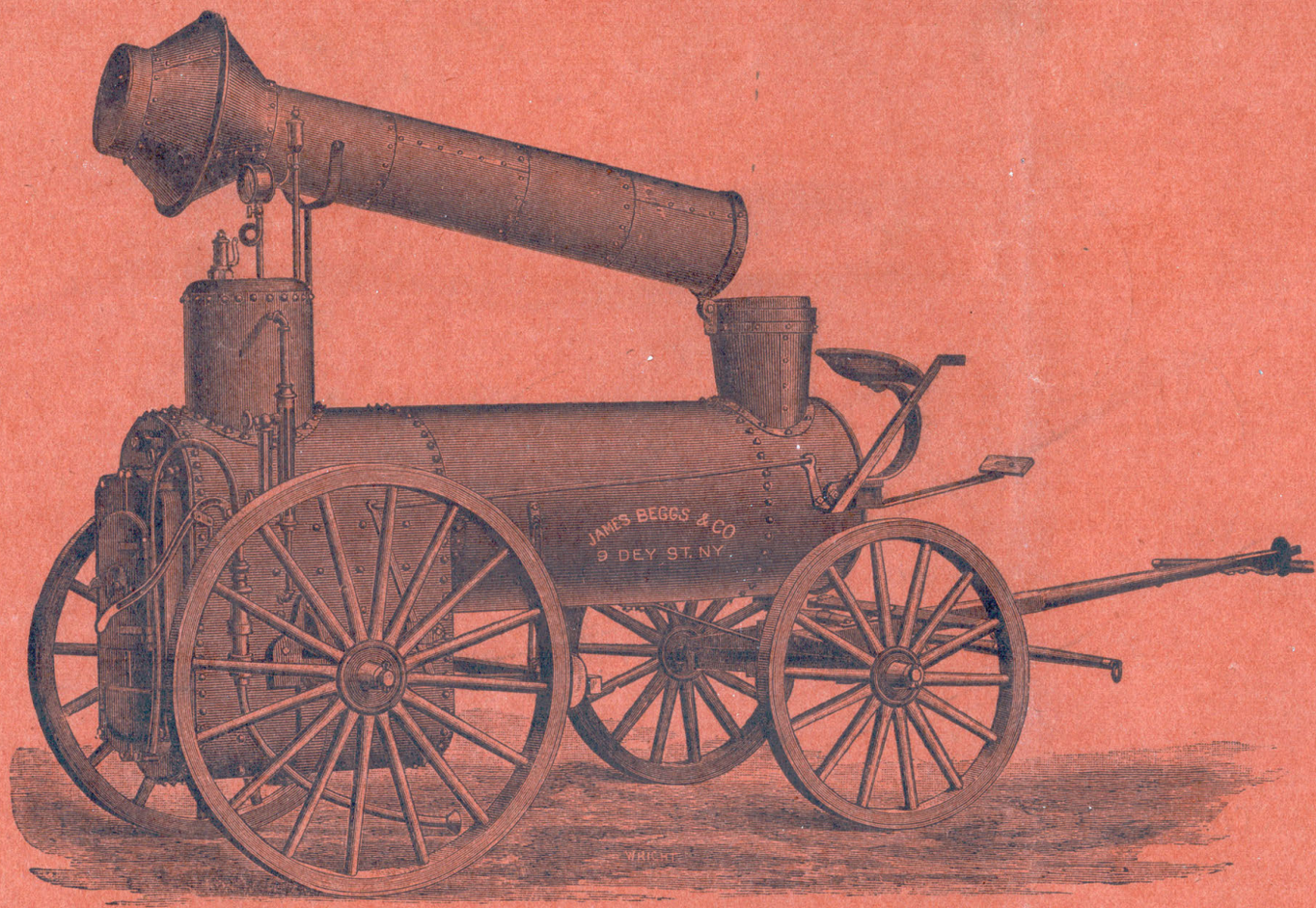
Price, with 24-inch Saw, . $



PORTABLE BOILER, WITH WATER BOTTOM AND WATER FRONT.

MOUNTED ON WHEELS.

For Specifications, see page 24.



PORTABLE BOILER, WITH WATER BOTTOM.

MOUNTED ON WHEELS.

For Specifications, see page 24.